

TP493

94

E11

691.9

SEP 19 1946

EAGLE- PICHER INSULATION

FOR LOW TEMPERATURE AND
COLD STORAGE APPLICATION

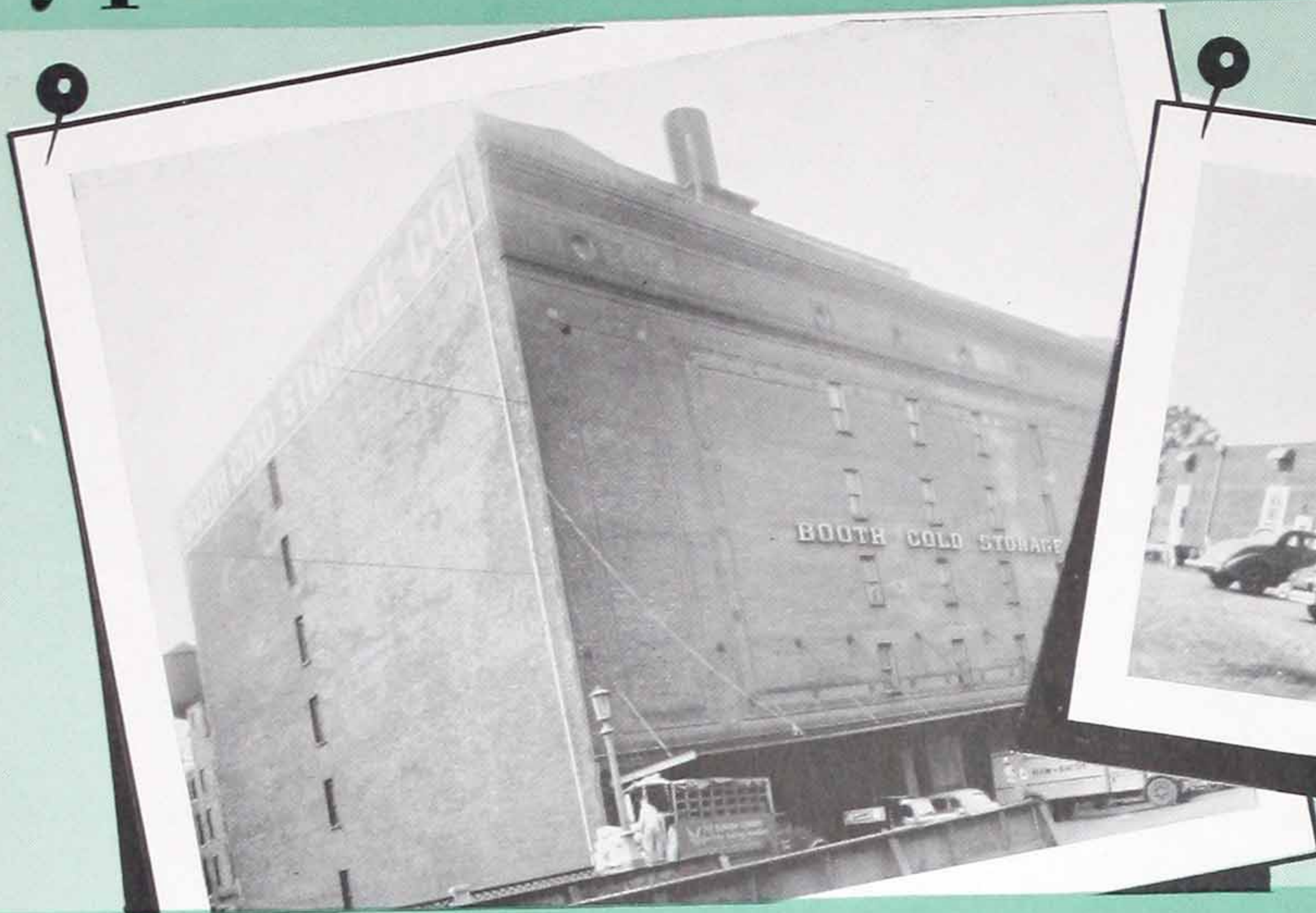


EFFICIENT
ECONOMICAL . .
LONG LASTING

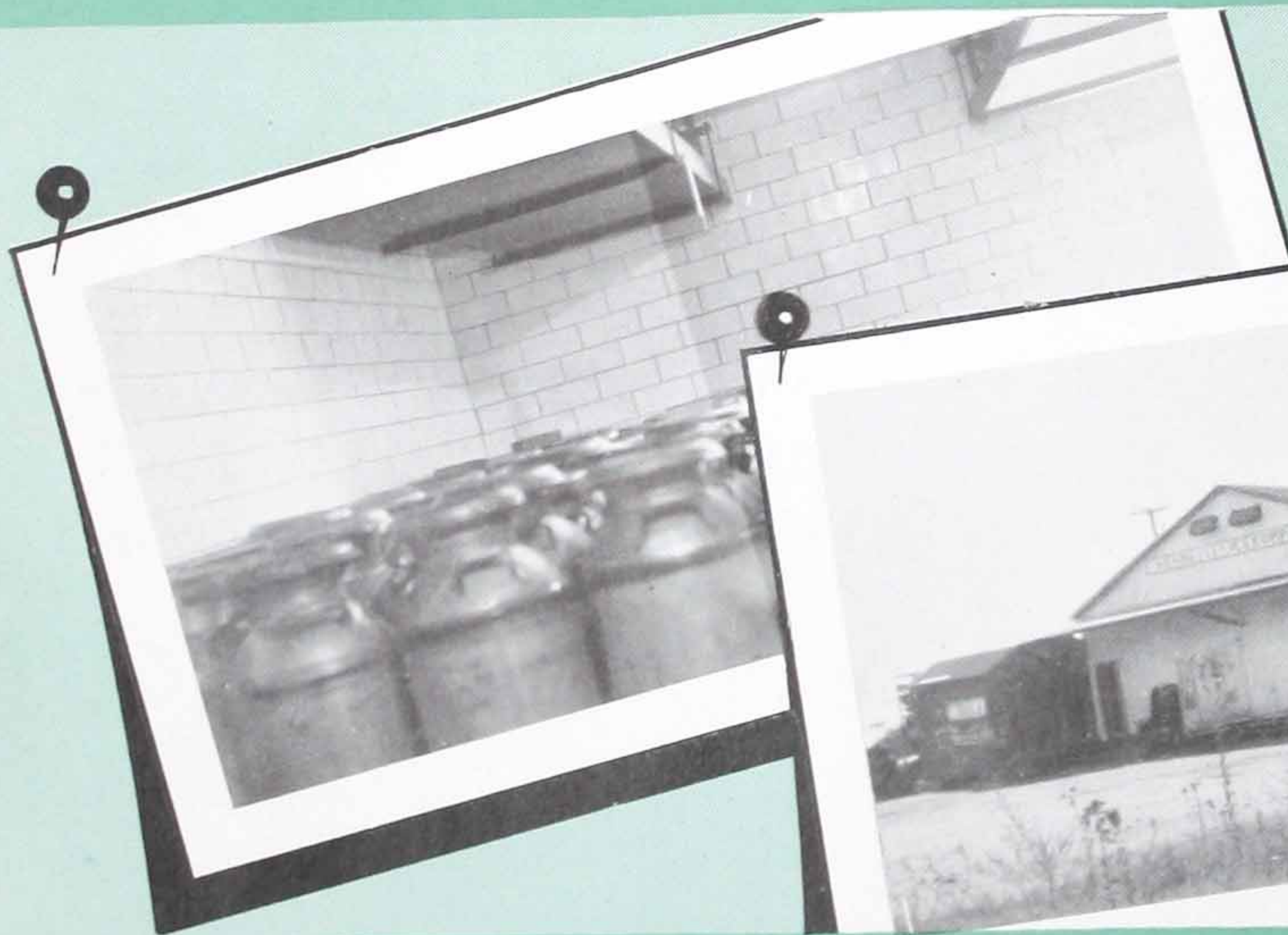
THE FRANKLIN INSTITUTE

LIBRARY

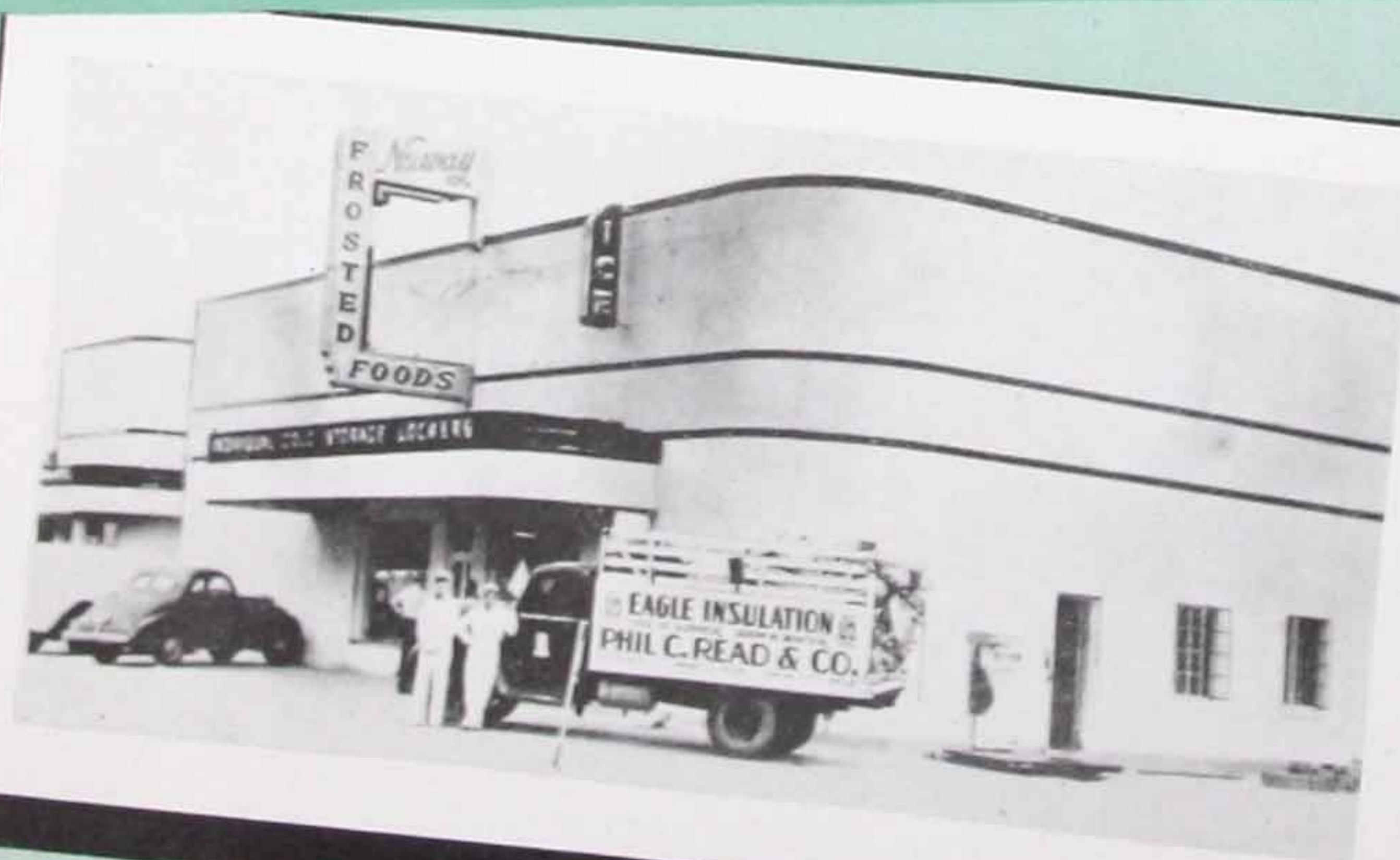
Typical Cold Rooms



All Protected With Water-repellent,



Fireproof, Permanent, Efficient Eagle Insulation!



AFTER YEARS OF RESEARCH

A NEW STANDARD for COLD STORAGE INSULATION



Eagle Insulation is made by The Eagle-Picher Company, in business since 1843, and one of the pioneers in the manufacture of mineral wool insulation. Almost twenty years research and advanced manufacturing techniques have resulted in a mineral wool that sets a new standard of efficiency for the cold storage industry . . . Eagle Insulation.

Imitation is the sincerest praise and Eagle Insulation is probably the most widely copied mineral wool . . . even to its once-unique dark color. But it is still unsurpassed because the inherent qualities of this insulation can be copied but not duplicated. It is these qualities of chemical and physical stability, water-repellency, fireproofness, lightness-in-weight,

resiliency of fiber, freedom from odors, durability, low thermal conductivity that combine to make it genuinely revolutionary in the cold storage field.

This book will accomplish only part of its purpose in establishing the superiority of Eagle Insulation for cold storage work if it does not, at the same time, impress upon the reader the importance of sound, competent workmanship in applying the insulation. The application instructions appearing on later pages are the result of exhaustive tests and broad engineering experience in low-temperature work. You are urged to read this book from cover to cover in the interest of efficient, economical and long-lasting cold storage installations.

THE EAGLE-PICHER COMPANY

10 89-88293-100

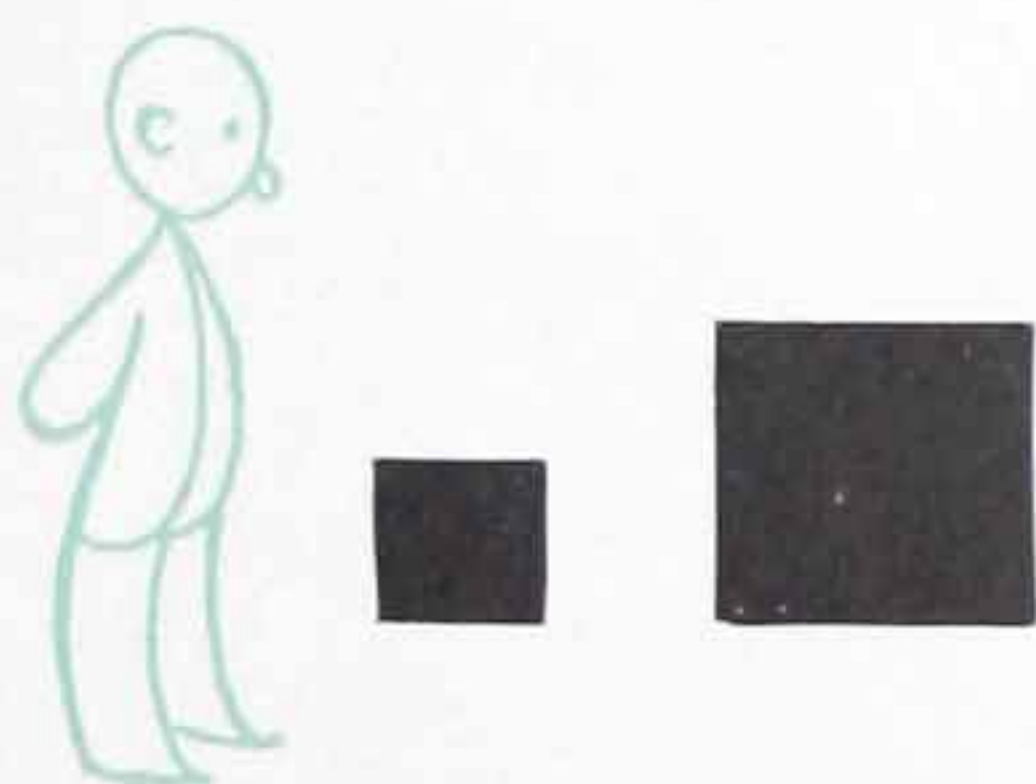
YOU GET MORE FOR YOUR INSULATION DOLLAR

WITH **EAGLE INSULATION**

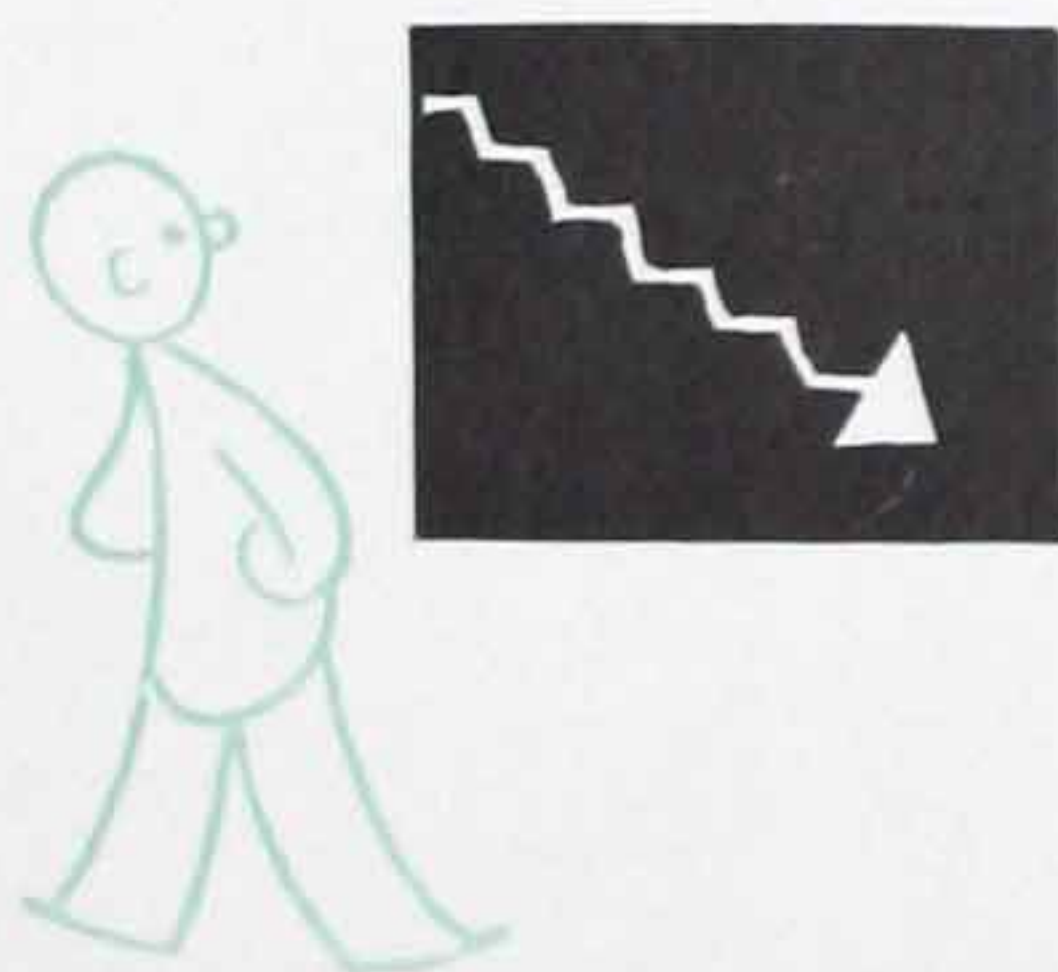


HERE'S WHY:

Eagle Insulation is remarkably *light-in-weight* because approximately 96% of it is composed of myriads of tiny dead air cells, so vital to insulating efficiency. This extreme light weight makes possible a *thicker, more efficient layer of insulation*.



The mineral wool fibers of Eagle Insulation are long and fluffy . . . each one resilient as a tiny spring. This means that the insulation does *not settle*, that its efficiency never decreases because of voids and unfilled spaces. This fact, together with its inherent *low thermal conductivity* permits the *installation of smaller cooling units*.



Because the *permanent efficiency* of Eagle Insulation permits the installation of smaller cooling units and freezing equipment, considerable money is saved on the *initial cost* of such equipment and on its *continued operation and maintenance*. And Eagle Insulation itself never needs repair or renewal . . . It lasts as long as the minerals from which it is made!

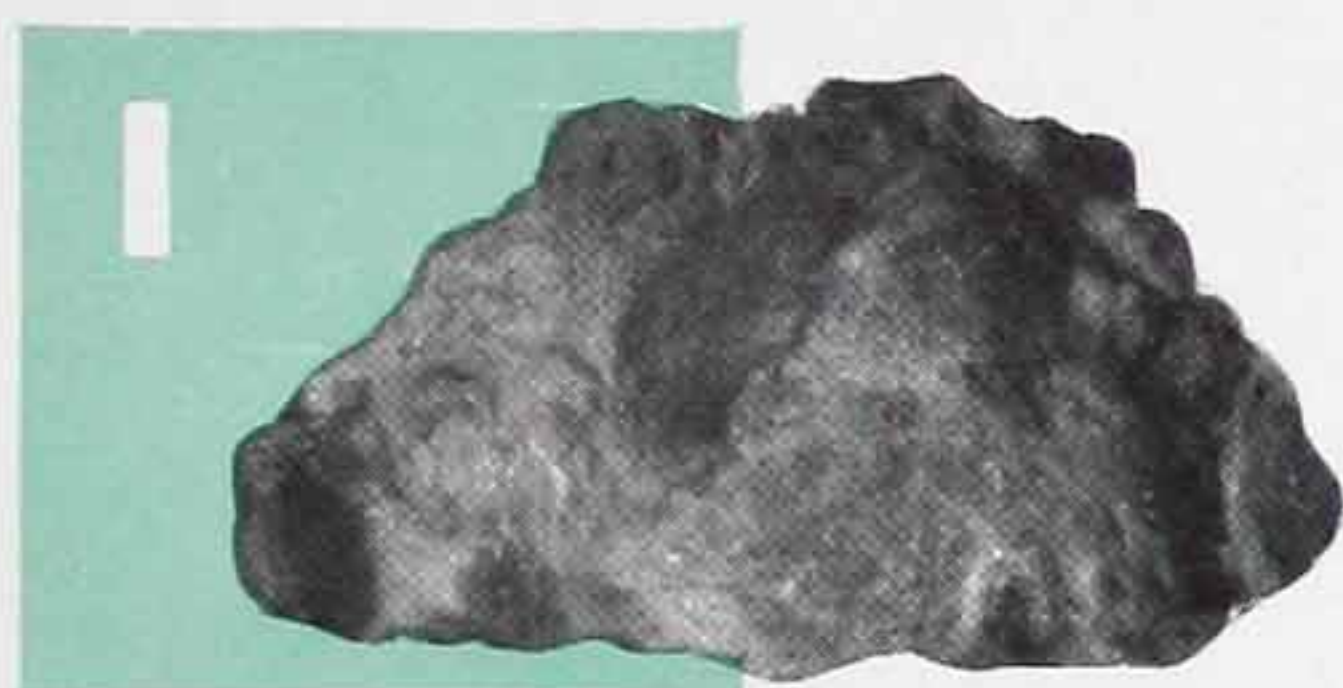
BECAUSE
EAGLE INSULATION
IS THE ONE
INSULATION THAT
HAS ALL OF THESE
ADVANTAGES

- Fireproofness
- Durability
- Chemical and Physical Stability
- Non-Conductor of Electricity
- Approval of Underwriters Laboratory
- Water-Repellency
- Reclaimability
- Odorless
- Vermin Repellency
- Conformance with Commercial Standards
- Permanent Efficiency

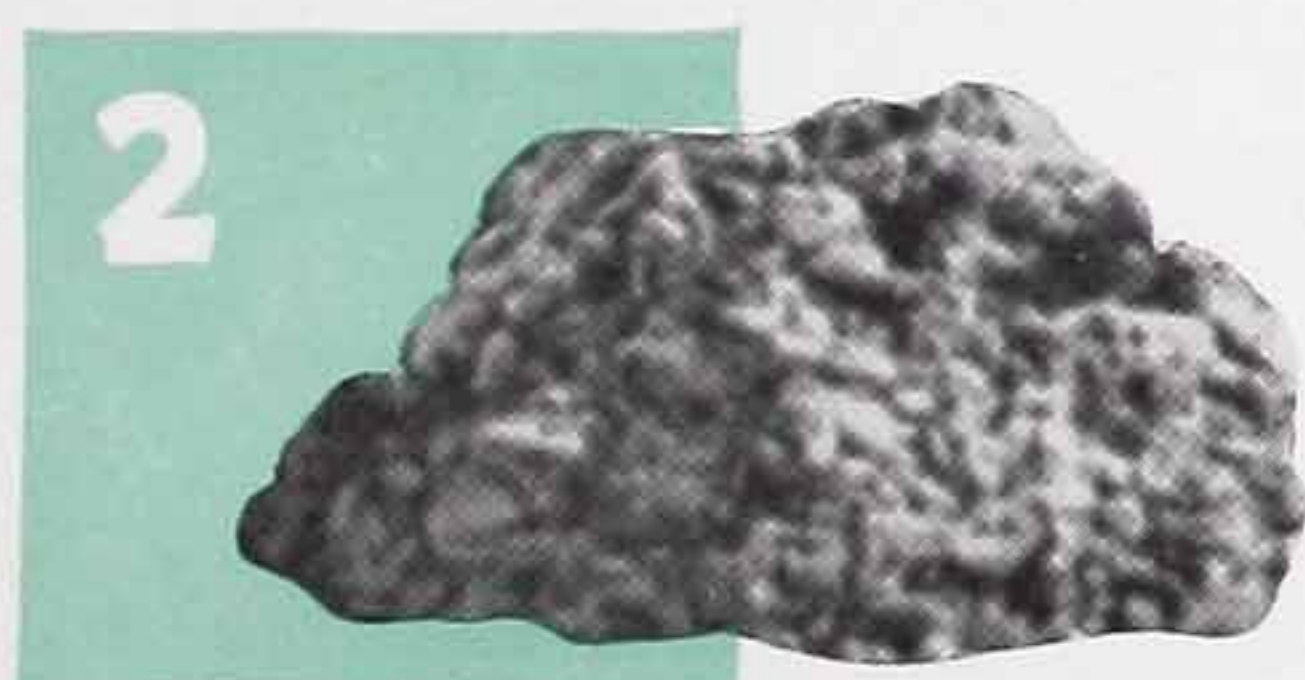
THESE 3 FORMS OF **EAGLE INSULATION** PROVIDE BETTER, MORE EFFECTIVE PROTECTION

Eagle Mineral Wool Insulation is available in loose, granulated and semi-rigid felt. Since all forms of the product are made from the same basic mineral wool

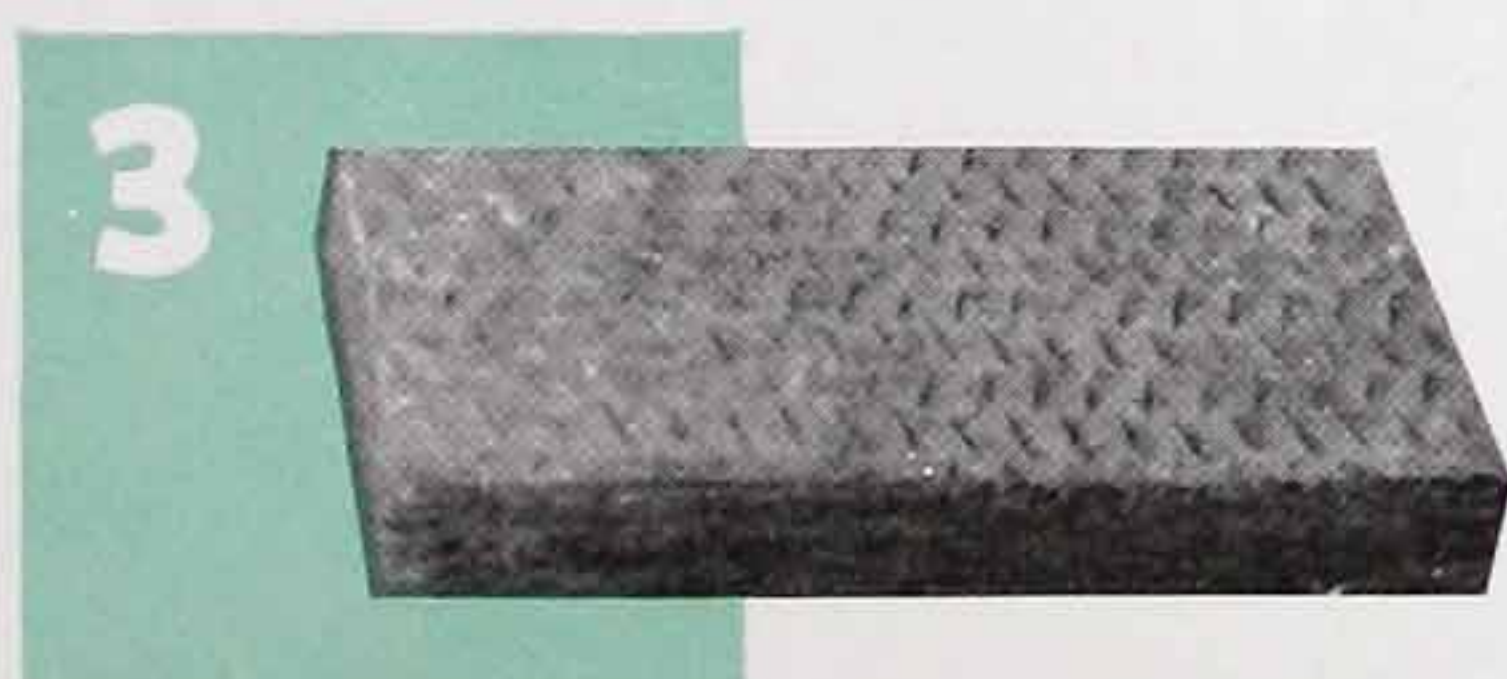
fibers, the outstanding qualities discussed on the previous pages are applicable to all types of Eagle Insulation outlined below.



Loose Wool — This is the original product as blown from the furnace without subsequent treatment. It is from this that all Eagle Mineral Wool Products are made. Fibers are fine and resilient and are of scientifically controlled size for maximum thermal efficiency. It is an excellent fill-type of insulation for use where a bulk insulation is required or specified.



Granulated Wool — Small pellets, approximately half inch in size which are usually applied by the pneumatic method illustrated on pages 22 and 23. It is especially suited for filling irregular spaces or enclosed areas that could not be reached by other means.

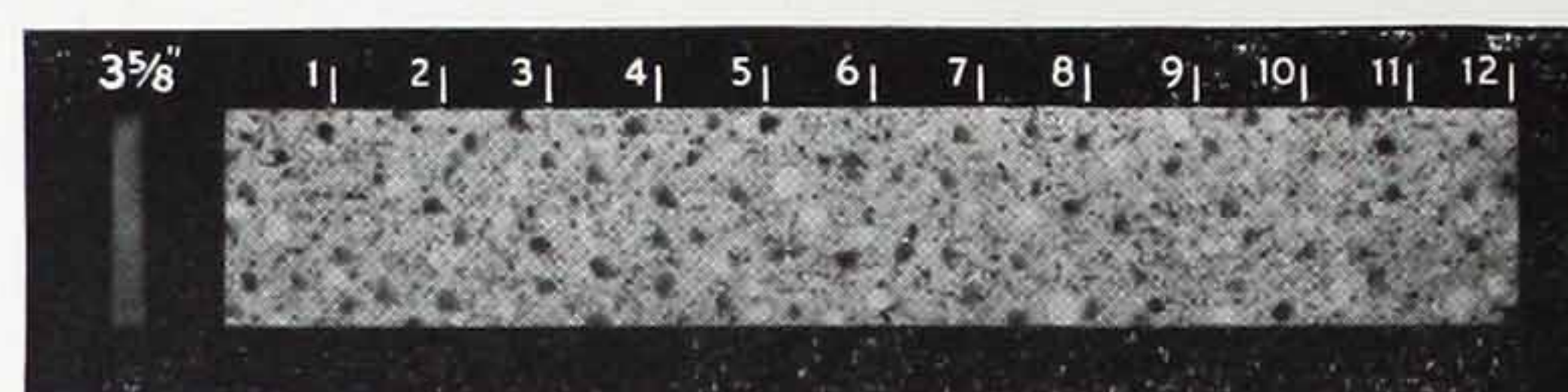
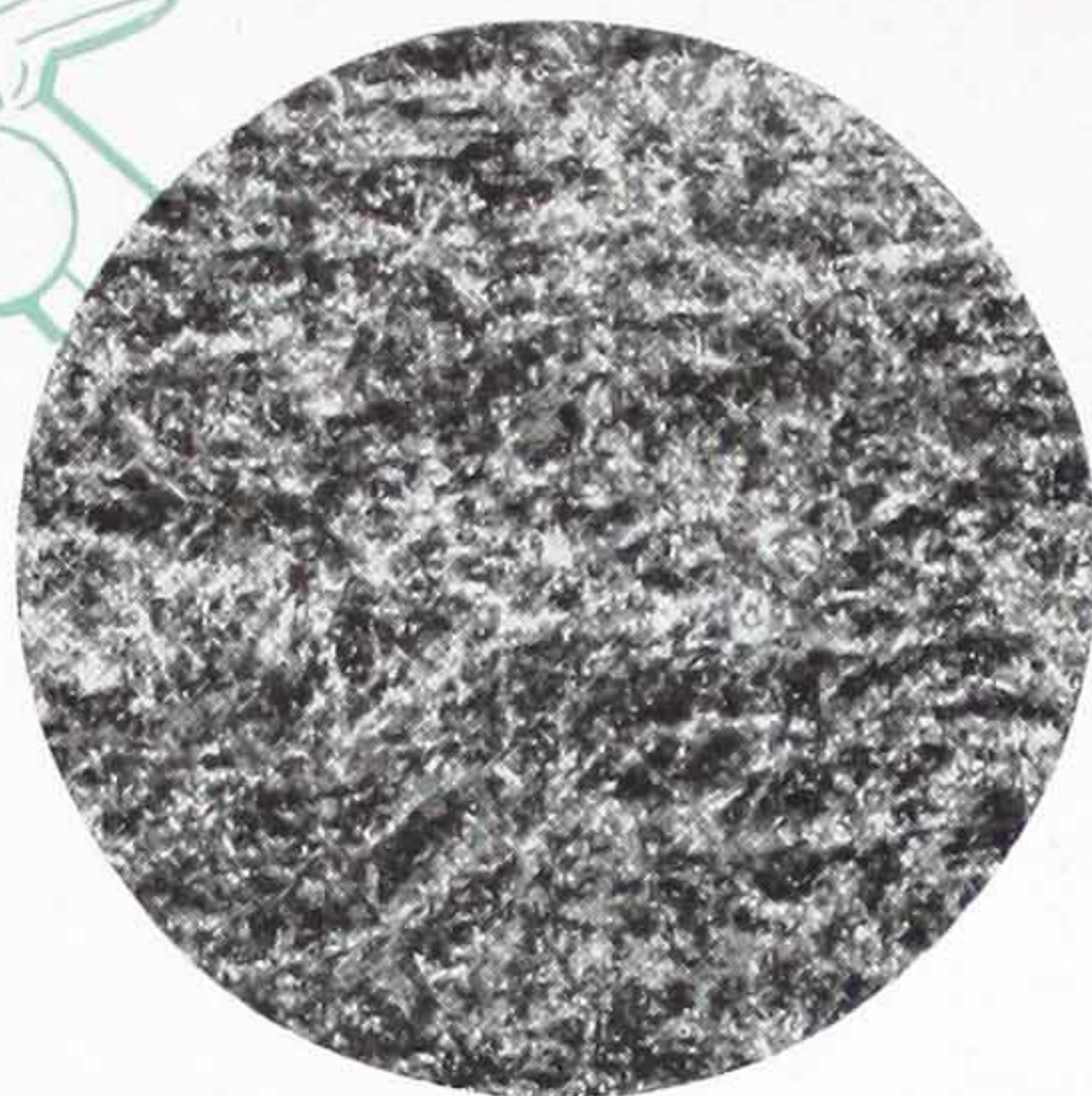


Felts — Eagle Mineral Wool fabricated into convenient sizes of semi-rigid felts by means of a special manufacturing process and by use of a strong binding ingredient. Gives outstanding performance at temperatures ranging from far below zero up to 400°F. Standard density is approximately 6 lb. per cu. ft. but it is also available in an 8 lb. density where a greater degree of rigidity is desired. Sizes are 24" x 30" in thickness of 1" to 4" inclusive. Special sizes are also available.

WHATEVER TYPE YOU USE, YOU GET MORE FOR YOUR INSULATION DOLLAR

MAXIMUM EFFICIENCY IS CHARACTERISTIC OF

EAGLE INSULATION

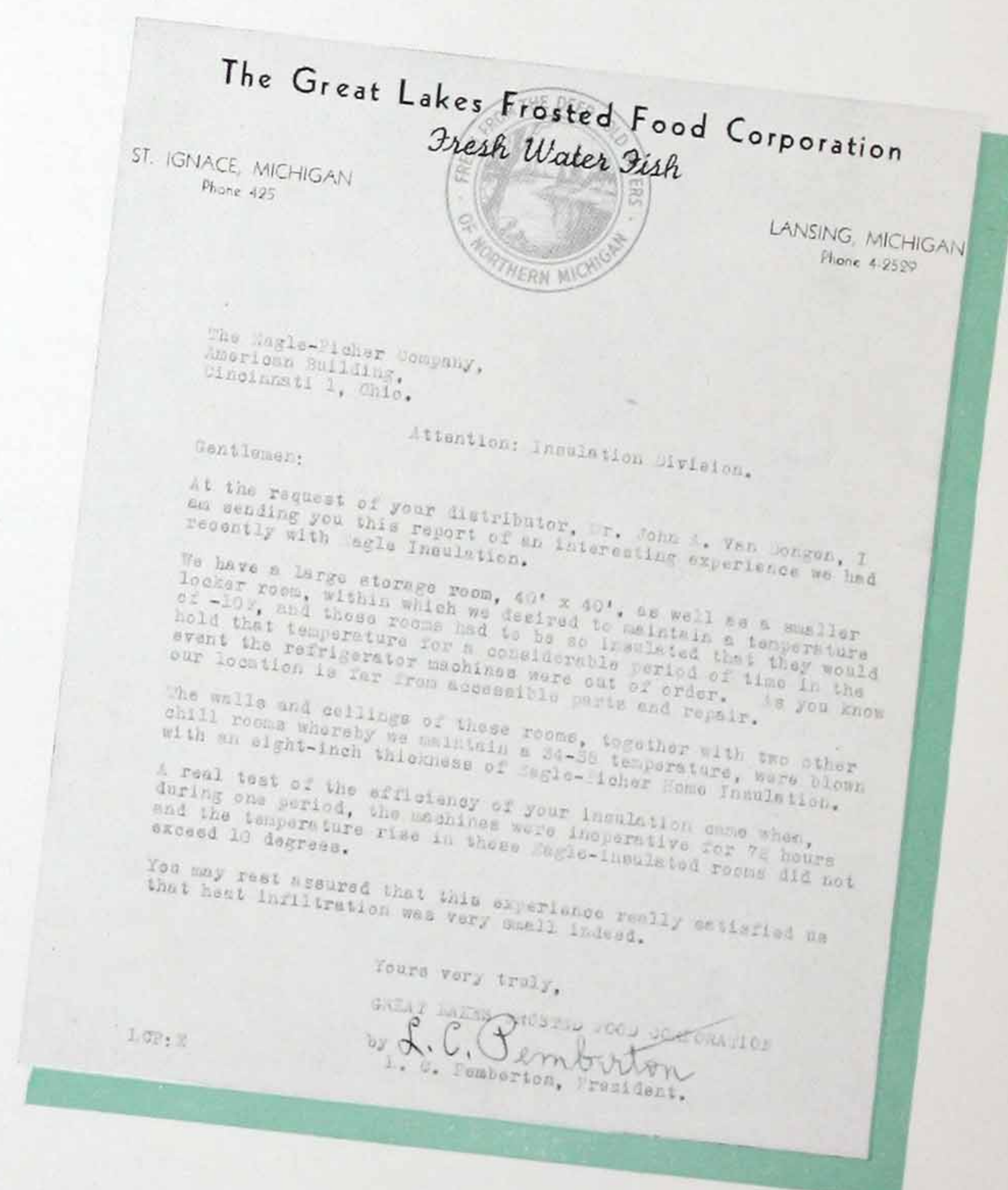


3 ⁵/₈ inches of Eagle Insulation has the insulating efficiency of twelve feet of concrete.

EAGLE INSULATION GIVES MAXIMUM EFFICIENCY

Authoritative tests by Purdue University show that Eagle Insulation has the low conductivity rating of 0.243 B.t.u. at 70°F. mean temperature. This great thermal efficiency is derived from the millions of dead air cells which are trapped by the fine mineral wool fibers of Eagle Insulation. These dead air spaces effectively stop the flow of heat, keep it from getting inside your cold room.

The importance of this efficiency is shown in a letter written by the president of the Great Lakes Frosted Food Corporation. He wrote that although their cooling equipment was once inoperative for a period of 72 hours, the temperature rise of the Eagle Insulated rooms never exceeded 10°!



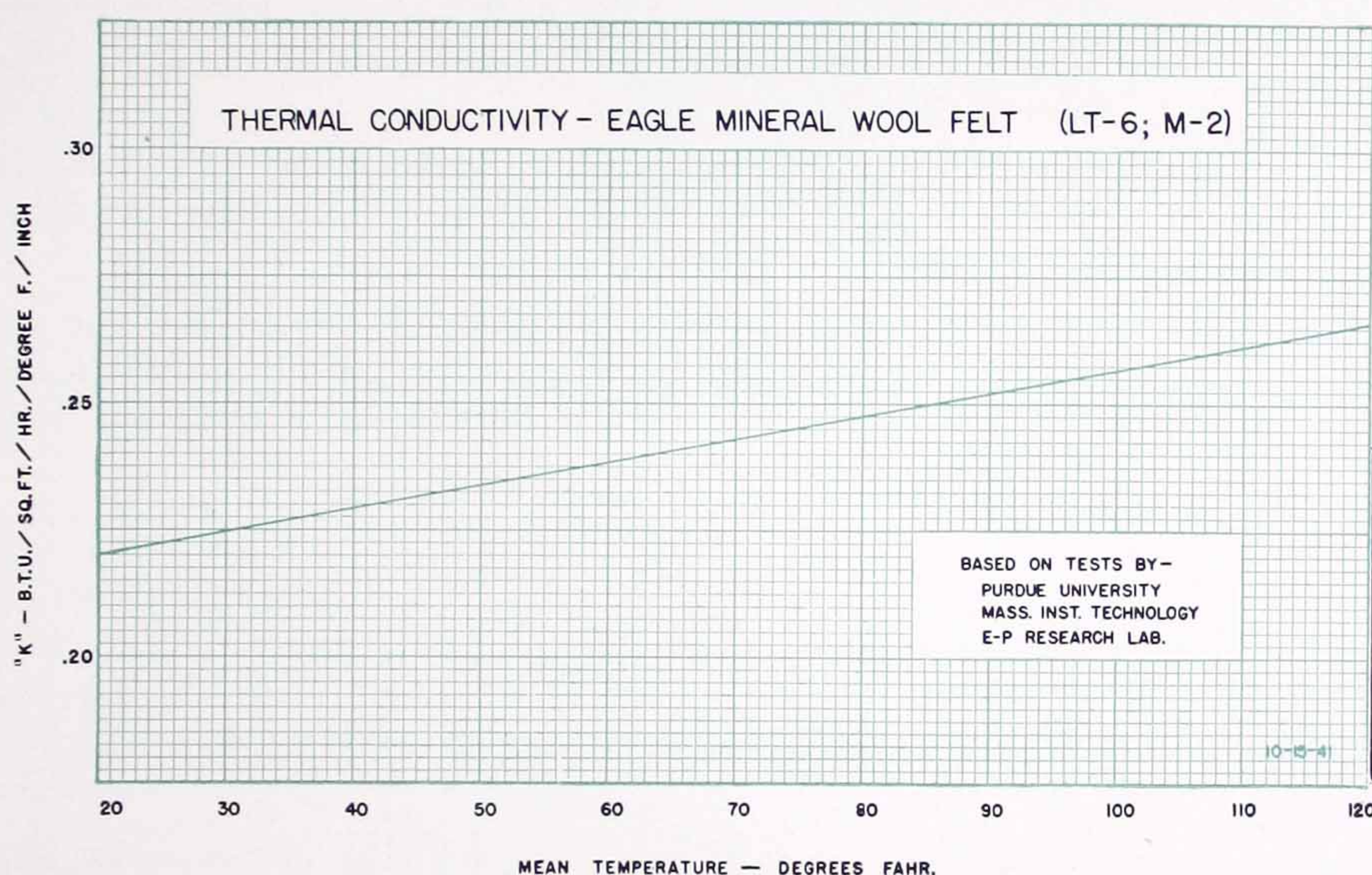
EFFICIENCY IS PERMANENT

Equally important to cold storage operators is the fact that Eagle Insulation is permanently and lastingly efficient, and chemically inert. When the springy, resilient fibers of Eagle Mineral Wool are installed to meet your rigid heat gain requirements, you may be sure that Eagle Insulation will continue to meet these same requirements year after year.

This *permanency* provides a high degree of economy because it means that Eagle Insulation does not need to be replaced or renewed, that it requires no upkeep or maintenance cost, that it lasts as long as the cold storage unit itself lasts . . . and even then it can be reclaimed and re-used! There is no evidence to show that Eagle Insulation will ever "wear out."

IF YOU WANT PERFORMANCE, STUDY THIS

THERMAL CONDUCTIVITY CHART



This chart shows the low thermal conductivity of Eagle Mineral Wool Insulation at any mean temperature from 20°F. up to 120°F. Example: to find the thermal conductivity at 70°F. mean temperature, follow the perpendicular line marked 70 to the point where it intersects the diagonal line representing the

conductivity of Eagle Mineral Wool. Follow the horizontal line from this intersection to the left hand edge of the chart where the thermal conductivity for the given mean temperature is found to be approximately 0.243 B.t.u. Note how the "K" factor improves as the mean temperature is reduced.

LOW THERMAL CONDUCTIVITY IS IMPORTANT

The *low thermal conductivity* of Eagle Insulation is extremely important in cold storage installations because it means that less Eagle Insulation is necessary to obtain the same results provided by more insulation of any type having a higher thermal conductivity. It also means that with an equal amount of Eagle Insulation, there is less loss through heat leakage. Thus in either instance, the low thermal

conductivity of Eagle Insulation offers a *plus feature*. A savings in refrigeration loss provides a corresponding economy in the initial outlay for cooling equipment and in its operating cost. This saving is unchanged throughout the permanent life of Eagle Insulation, too, because the efficiency of the mineral wool is not lowered by fiber deterioration... a deterioration that cannot occur in this superior insulation.

THERE'S NO WEAR-OUT TO

EAGLE INSULATION ... IT'S DURABLE!



Scientific blending of selected minerals to a rigid formula for fusing into mineral wool and the inherent characteristics of each component mineral itself explain the unique *chemical and physical stability* of Eagle Insulation, explain its matchless durability. Melted in specially designed furnaces, the molten mineral mass is blown into long, fibrous wool which is as durable as the minerals themselves.

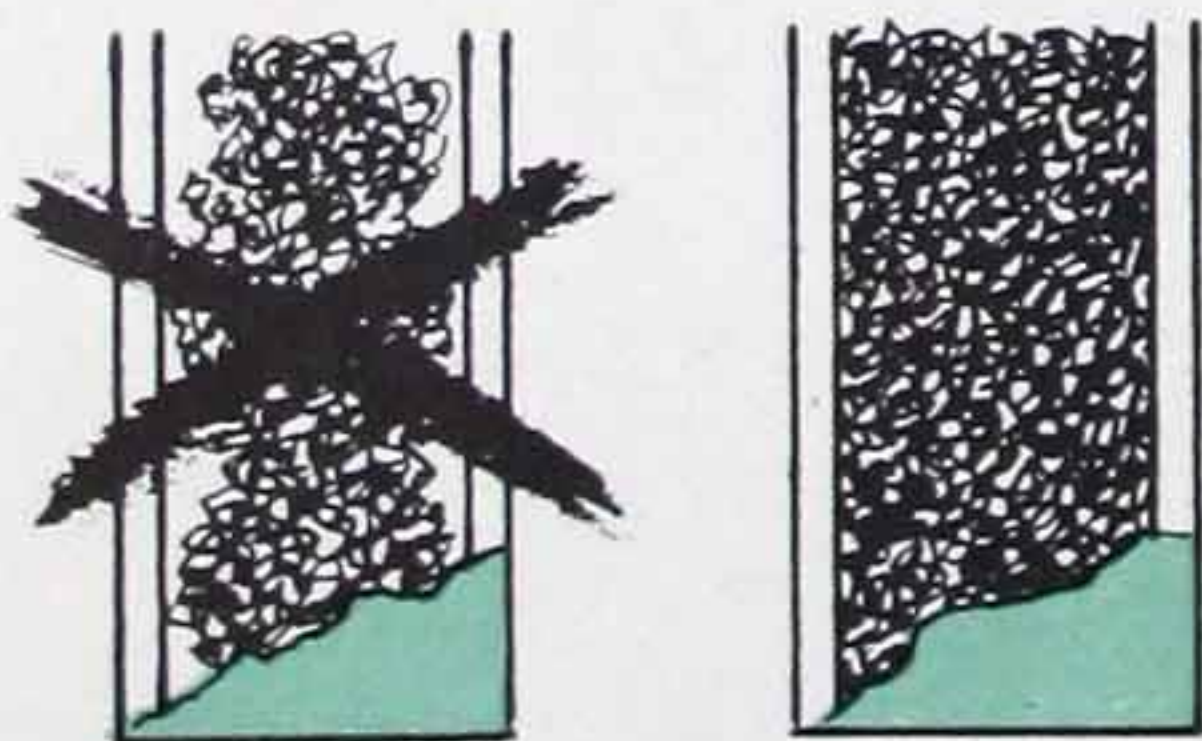
Once formed into wool, there is no further mineral mutation of Eagle Insulation; its fibers do not deteriorate, they are stable! As a consequence, Eagle Insulation is unaffected by water; it does not rot, "carbonate," slake or powder away. It is durable!

Eagle Insulation is odorless and contains no vegetable matter or any other element that will facilitate spoilage, attract vermin or undesirable rodents . . . all-important factors where foodstuffs are to be stored as in locker plants or cold storage warehouses.

NO VOIDS OR OPEN SPACES

... IT'S NON-SETTLING!

Because the fibers of Eagle Insulation are resilient as tiny springs, they do not settle even under severe conditions of vibration. Contrast this with rigid type insulations in cold storage installations where perhaps the building settles, or, due to temperature difference, the walls tend to expand and contract. In such cases, the rigid insulation and the vapor seal may crack severely . . . even the length of a cold room! Mineral wool, on the other hand, has sufficient resiliency to give and take with this movement so that the insulation remains unaffected and its efficiency unimpaired.



Eagle Insulation holds its position wherever it is installed, leaving no uninsulated voids where heat can enter and cause food spoilage. This remarkable non-settling quality was proven by a special test which vibrated an Eagle Insulated panel a height of $\frac{1}{4}$ inch, 27,840 times . . . a test far more severe than would ever be encountered in actual application. The results of this test showed that the volume of wool was only fourteen-thousandths less than the original volume . . . irrefutable evidence that Eagle Insulation stays in place and is non-settling!

INHERENTLY WATER-REPELLENT, *EAGLE* INSULATION IS UNAFFECTED BY MOISTURE



IT DOES NOT DISINTEGRATE OR CHANGE FORM... IT DOES NOT ROT

The natural characteristics of the minerals from which Eagle Insulation is made, and the unique manufacturing methods used in fabricating it, give it *water-repellency*. This means it is chemically stable in the presence of water.

Unaffected by moisture, this different, superior mineral wool neither disintegrates nor changes form. It does not become an electrical conductor. Water does not make it rot.

Rigid-type insulations, on the other hand, will absorb moisture if the vapor seal is broken. Not only

does this speed their tendency to rot, but then moisture freezes within the rigid insulation, the latter cracks, breaks and may even cause the walls to bulge out. Eagle Insulation may get wet from moisture vapor if the vapor seal is imperfect, but it has sufficient flexibility of fibers so that if any freezing does occur within the walls, they will not tend to bulge and break out. Moreover, the mineral wool will not be harmed in any way. Here is a unique advantage of Eagle Insulation because it means this wool can be removed, dried out . . . and most important, it loses none of its original efficiency!

PERMANENT INSULATION PLUS AN EFFICIENT VAPOR BARRIER RESULTS IN LASTING EFFICIENCY

The economical, efficient construction of any cold storage work is dependent on two factors; a continuous "blanket" of durable insulation around the refrigerated space with a continuous unbroken vapor seal on the outside. The two are interdependent, and the satisfactory operation of cold rooms over any length of time hinges largely on the impermeability,

the tightness of the vapor seal. If the seal is not secure, trouble will soon develop . . . the degree of trouble based on the quality of the insulation.

Further details on the subject of vapor barriers and their importance in good cold storage construction are given on subsequent pages in this book.

TRY A BLOW-TORCH ON **EAGLE INSULATION**

... IT'S FIREPROOF!



LOG OF FIRE TEST MADE UPON EAGLE INSULATING WOOL

Duration of fire in Mins.	Temperature of Furnace	Temperature of outside surface of panel
0	85	83
9	1210	83
21	1621	130
30	1700	154
39	1740	158

Columbia University Test shows Eagle Insulation remarkably efficient at all temperatures!

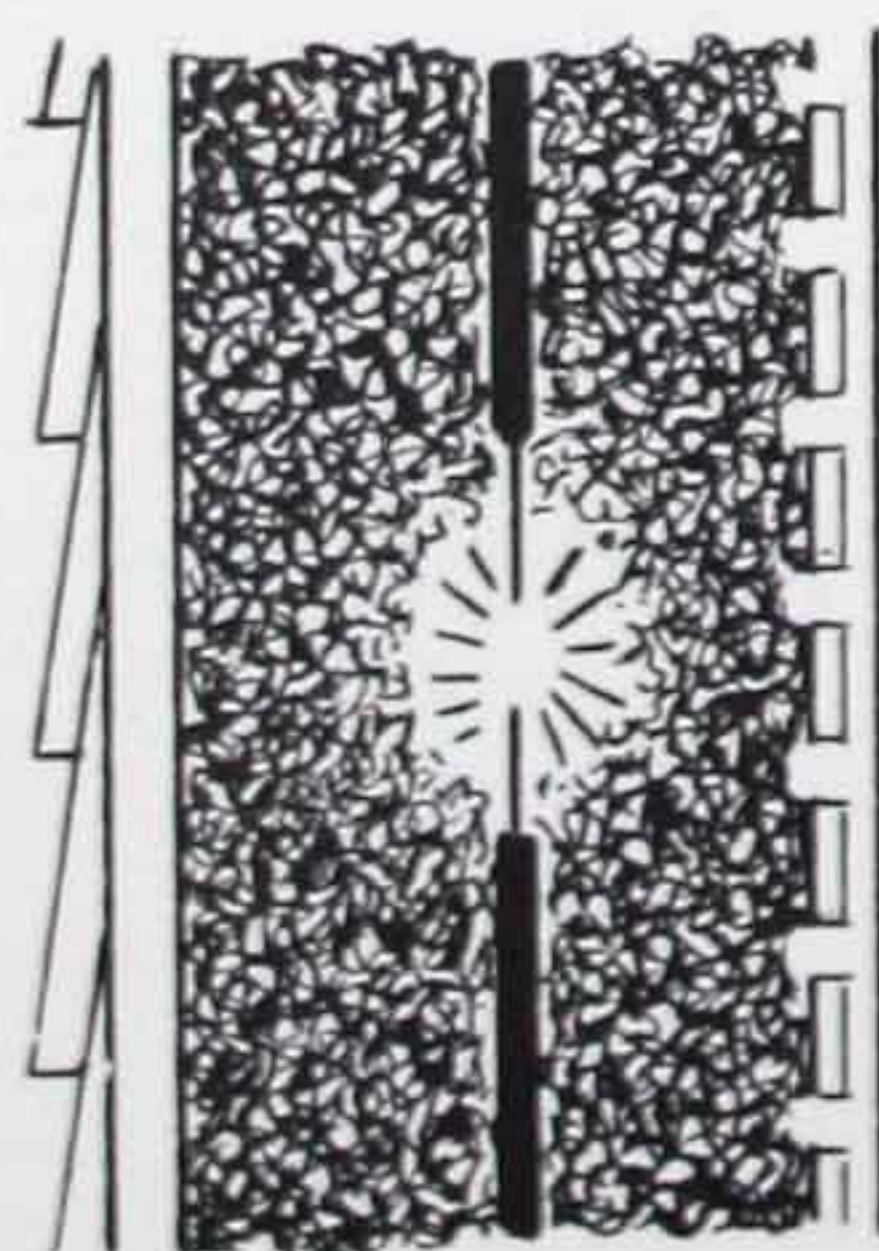
The very origin of this unique, efficient mineral wool is evidence of its resistance to heat and flame. Blown from molten minerals at very high temperatures, Eagle Insulation is fireproof far beyond the range of ordinary fires. The addition of special fireproofing chemicals has not been necessary to achieve this highly desirable quality. Consequently Eagle Insulation contains no ingredients that might eventually fail and cause the insulation to lose its fire-resisting effectiveness.

After passing rigid tests, Eagle Mineral Wool has been approved as a fireproof insulating material by the U. S. Bureau of Standards and U. S. Maritime Commission.

Eagle Insulation is *naturally fireproof* ... even a blowtorch doesn't make it burn! This added protection may prove to be worth many times the original cost of the insulation.

APPROVED BY UNDERWRITERS' LABORATORY ...

IT'S A NON-CONDUCTOR OF ELECTRICITY!



As a result of exhaustive studies conducted by the Underwriters' Laboratory, based on Loose Connections, Burnout and Dielectric Tests, Eagle Insulation was proved by these unbiased experts to meet the requirements of the National Electrical Code.

Sparks thrown off by short circuits or broken wires within the walls of your cold storage room are absorbed and "muffled" by the mineral wool, and are prevented from reaching the highly combustible building materials such as wood, paper, and asphalt that are used in the construction of the cold room walls. If your cold storage room is in the same building with your office, an office fire would have great difficulty in spreading through Eagle Insulation to the interior of the refrigerated space.

EAGLE INSULATION CAN BE USED OVER AND OVER ... IT'S RECLAIMABLE!



Eagle Loose Wool and Eagle L.T. Felt are shown after being removed from a cold storage room that was to be remodeled. The insulation was completely unaffected by temperatures as low as 109.6 F. below zero, and was in excellent shape for re-use. It was, in other words, 100% reuseable.

Eagle Insulation has the unique quality of being *reclaimable*. It can be used over and over again because it is permanent, it does not wear out and, it does not lose its efficiency.

Reclaimability of this insulation is a valuable feature . . . especially in those cases where cold rooms are rebuilt, remodeled, enlarged, or where the vapor seal proved to be imperfect, thus necessitating repairs or entire reconstruction. In all such cases Eagle Insulation can be removed, replaced in position and, what is most important, give the same efficient insulating performance as when originally installed!

Because Eagle Insulation is reclaimable, it does not need to be renewed or replaced. Its first cost is the last cost . . . and that is important economy!

CONFORMS TO RECOGNIZED STANDARDS OF EFFICIENCY EAGLE INSULATION MEETS RIGID SPECIFICATIONS



This seal, appearing on Eagle-Picher packages, indicates that Eagle-Picher Mineral Wool meets all recognized standards for low temperature work.

The release by the U. S. Department of Commerce of their Commercial Standard CS-105-43 indicates that 9 branches of the Government, more than 225 privately owned companies and 9 important trade associations have endorsed the use of mineral wool insulation for low temperature or cold storage applications. These are the recognized standards for insulation in this important industry, and it is significant that Eagle Insulation meets these specifications with banners flying.

There are three forms of Eagle Insulation manufactured for cold storage work; Eagle Type H-2 Loose Wool, Eagle Type 7-B Granulated Wool and Eagle Low Temperature Felt. Needless to say, all three forms meet Commercial Standard CS-105-43 which is ample evidence of their low thermal conductivity and inherent durability.

IMPORTANT ECONOMIES MAY BE EFFECTED BY **INSULATING TO RECOMMENDED THICKNESSES**

Eagle Insulation is not only highly efficient, it is also low in cost. This fact enables you to get a thicker, more efficient layer of it than an equal or even larger amount of money would give when spent for some other forms of insulation. Unless you've made a comparison, you can't possibly know how great is this difference.

SLASHING OPERATING AND MAINTENANCE COSTS

You will find that a greater thickness of the thermally efficient Eagle Insulation will, in many instances, permit you to install a cooling unit with lesser horsepower than you had anticipated. You will find, too, that the cooling unit you do install has less work to do, slashing operating and maintenance costs and depreciation for the life of the equipment.

RECOMMENDED MINIMUM THICKNESSES

Temperature	Recommended Thickness
50°F. and up	2 inches
40°F. to 50°F.	3 inches
30°F. to 40°F.	4 inches
0°F. to 30°F.	6 inches
-20°F. to 0°F.	8 inches
-40°F. to -20°F.	10 inches

The above thicknesses are minimum. Wherever possible the supplier of the refrigerating equipment should be consulted, for an added inch of insulation may permit reduction in the size of equipment required, thus lowering first cost of equipment and increasing economy of operation during the entire life of the equipment.

For example, one manufacturer rates his water-cooled refrigerating machine at 70°F. condensing and 15°F. suction, temperature as follows:

REFRIGERATION CAPACITY TABLE

Motor Horsepower	Refrigerating Machine Capacity
5 H.P.	23,600 B.t.u.
3 H.P.	17,600 B.t.u. (Large compressor)
3 H.P.	12,200 B.t.u. (Small compressor)
2 H.P.	11,500 B.t.u. (Large compressor)
1½ H.P.	8,700 B.t.u.
1 H.P.	6,050 B.t.u.

In a freezer storage room 20' x 30' x 8', heat leakage with 4" of Eagle Insulation would be 16,600 B.t.u. Heat leakage with 6" of insulation would be 12,600 B.t.u., or a difference of 4,000 B.t.u.

DECREASING ORIGINAL INVESTMENT COST

If the heat load—other than leakage—were 5,000 B.t.u., the total heat loads would be, respectively, 21,600 B.t.u. and 17,600 B.t.u. Consulting the temperature chart above, we see that with 4" of insulation a 5 H.P. machine and a correspondingly larger cooler unit would be required. With 6" of insulation, however, a 3 H.P. motor would be adequate, thereby appreciably decreasing both the cost of the original investment and the cost of operation.

Eagle Insulation is also economical because it is permanent; there are no repair or maintenance expenses. Eagle Insulation is virtually indestructible and will last as long as your cold storage room stands.

SUPERIORITY OF RECOMMENDED CONSTRUCTION IS BASED ON BEST ENGINEERING ABILITY AND EFFICIENT INSULATION

Too much emphasis cannot be placed on the importance of using the recommended construction details shown in this book. Low temperature installations do not permit experimentation or deviation from accepted procedures. The construction methods given in this manual are the result of the best in engineering ability and "know how." This ability combined with the top quality workmanship of com-

petent applicators and the permanent efficiency of Eagle Mineral Wool Insulation, assures a cold room installation that will meet the highest standards of the refrigeration industry.

The construction methods given on the following pages have many distinct advantages that provide greater efficiency and economy. For example:

1. The use of Eagle Mineral Wool Insulation instead of rigid insulating materials enables you to have 12" of insulation at a price less than 6" of the rigid material. Each additional inch of insulation means added savings in operating cost. This economy, plus the lower initial cost of mineral wool, results in less capital invested.

2. The conductivity of Eagle Mineral Wool is considerably lower than that of rigid insulating materials. Consequently with this recommended construction, you actually receive more than twice the insulating protection and at lower cost.

3. The use of Eagle Mineral Wool in this construction in place of rigid materials eliminates joints and buttments between the rigid forms as well as costly, time-consuming cutting and fitting of these pieces. Wooden or metal skewers are also dispensed with. Likewise it greatly reduces the amount of asphalt required . . . and *asphalt is not an insulator*.

4. Eagle Mineral Wool has resilient fibers which give and take with wall movement and vibration. In this respect, it is again superior to rigid forms which tend to crack and break thus penetrating the vapor seal and eventually causing the walls to bulge out.

5. When rigid insulations are laid against steel or other materials with a high coefficient of expansion, the inflexible material often separates and pulls away from the metal. As a consequence, condensation and freezing occur directly against the metal, forcing the rigid board still farther away. When Eagle Mineral Wool is used against cold metal, such as brine tanks, it fits snugly, and has enough resiliency to stay in place and not be pushed away.

OVERALL CONDUCTANCE FACTORS

Insulation	Wood Construction 7/8" Wood Sheathing Both Sides	Wood Construction No Sheathing (Plaster Finish)
2"	.125 BTU/HR/SF/DEG.	.170
3"	.100	.127
4"	.083	.102
5"	.072	.086
6"	.063	.073

These are based on insulation with "k" of .30. Therefore, these factors will give a substantial safety margin for Eagle Mineral Wool, varying from 14% to 22%, dependent upon wall construction and insulation thickness. You will note that these factors are actually higher than the "k" factor divided by the thickness. Where the studs are staggered and do not extend through the wall itself, a saving of 10 to 15% in heat loss may be expected.

VAPOR BARRIER

Due to the difference in vapor pressures between the outside air and the air in the refrigerator, vapor will penetrate through the siding and insulation and will condense on the siding inside the refrigerator, unless precautions are taken and an adequate barrier is installed on the warm side.

In special cases where temperatures are relatively high (banana or candy storage) and outside walls form part of the refrigerator, the warm side will reverse with change of seasons. When this happens, the barrier should be placed on the side which is pre-

dominately warmer. Except in extreme cases of temperature reversal, you should avoid placing the vapor barrier on both sides of the wall, as this does not allow moisture to escape. Similarly, when the insulation is installed in two or more layers, an intermediate vapor seal is not recommended.

Vapor seal should be able to withstand a small amount of expansion and contraction, and should have a permeability rating of not more than 1.25 grains of moisture per sq. ft. per hour per inch of mercury pressure difference.

ALL FRAME CONSTRUCTION

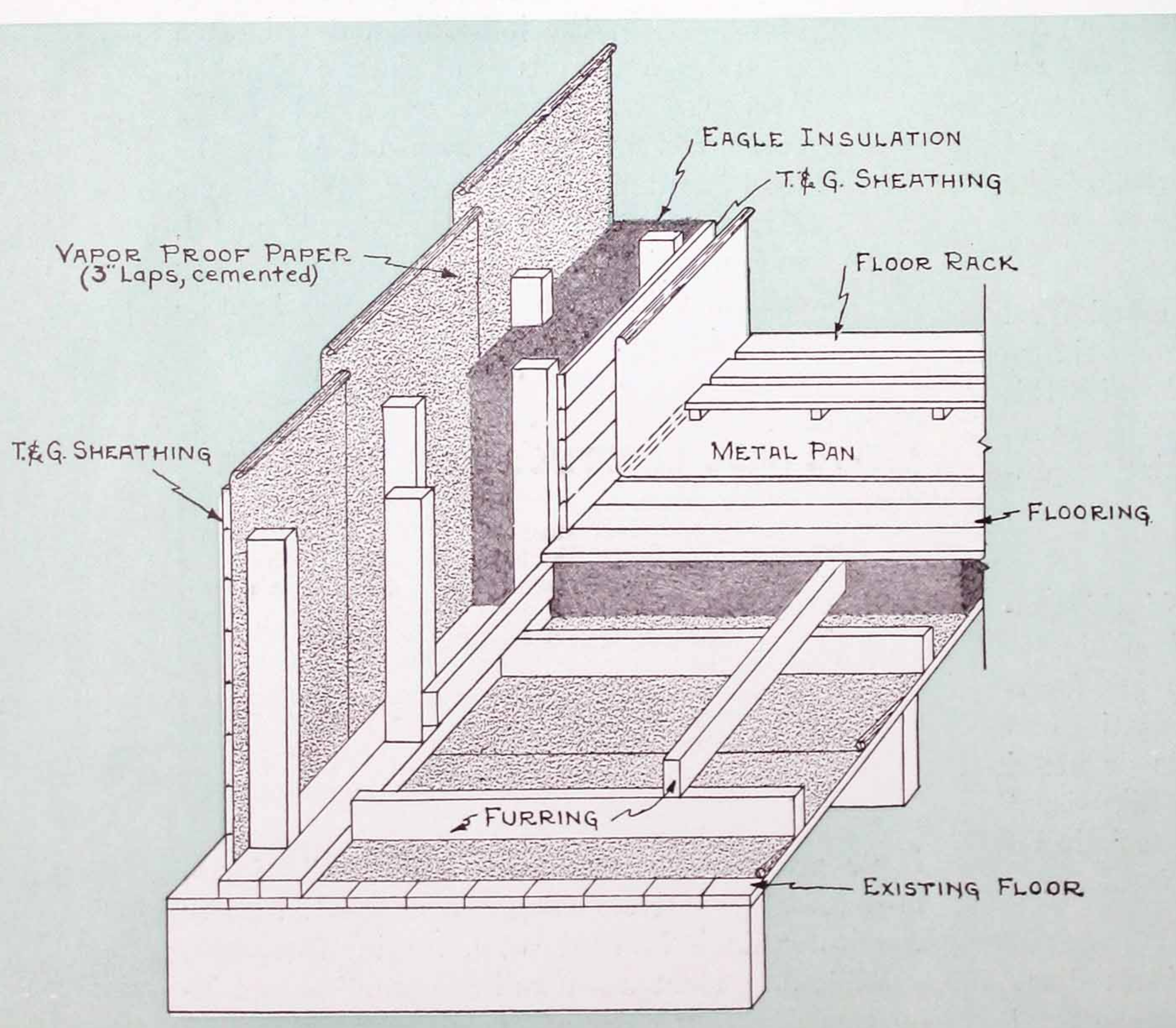


Fig. 1 — Drawing shows use of vapor barrier on all frame construction.

The vapor barrier must make a complete seal entirely around the warm side of the refrigerator and should meet the specifications shown above on this page.

All joints should be lapped 3" and cemented with asphaltic emulsion compound. Particular care must be taken at corners to insure a good seal. When refrigerator is to operate at temperatures below freezing, use two layers of vapor barrier, and for temperatures below 0°F., three layers of vapor barriers.

Asphaltic saturated materials, such as rag felt, do not in themselves make a good seal, as the asphalt is not continuous. Where these materials are used, two layers should be applied with a continuous coat of asphalt between them, and in refrigerated spaces operating below freezing, three layers should be used, with a continuous asphalt coating between each. This precaution is vitally necessary for top operating efficiency.

BRICK, CONCRETE, TILE, ETC.

Masonry walls must be thoroughly proofed against moisture vapor and moisture penetration before any insulation is applied. This is done by first brushing the surface free of all loose and foreign materials, and, when surface is thoroughly dry, filling out all voids with a coat of Portland Cement made up of one part Portland Cement and two and one-half parts clean sand. When dry, surface should be given one coat of asphalt, thin prime coat, and one heavy coat of asphalt emulsion. Apply one layer of vapor-proof paper over this. The first coat of Portland Cement may be omitted if the surface is smooth. All cracks must be filled, however, with asphalt emulsion before prime coat of asphaltic paint is applied. Apply two layers of vapor-proof paper for below freezing temperatures.

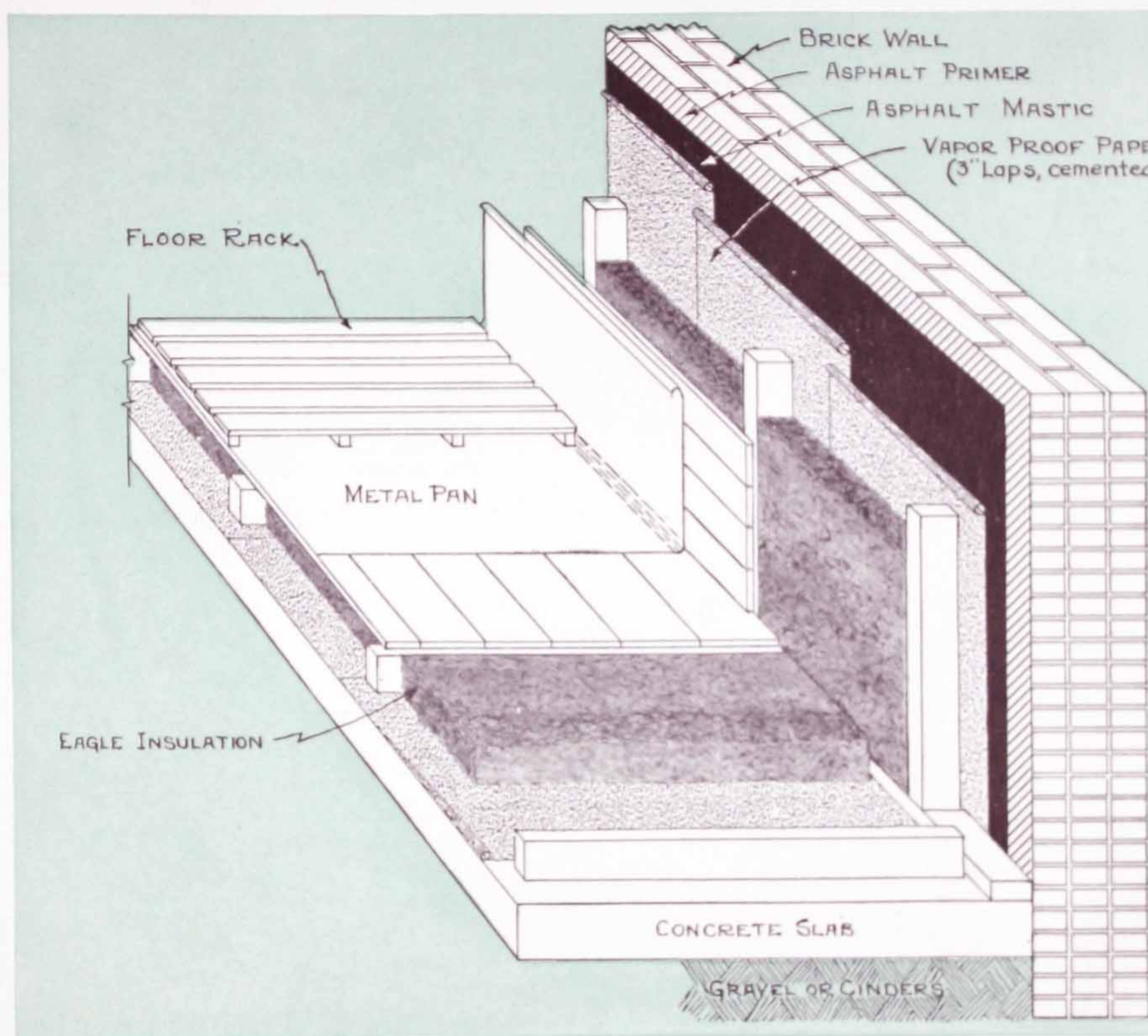


Fig. 2 — Masonry walls must be carefully prepared before installation.

WALLS

Erect 2" thick studs on 16" centers, placing flush against previously vapor-proofed wall. Studs shall either be full wall thickness or one-half wall thickness as illustrated. (See Figs. 2 and 3.) Full thick studs reduce labor cost but also reduce efficiency somewhat. (See Fig. 1 for staggered studding.) In low temperature freezer work, it is best to use one-half thick studs. This construction will add little to

MASONRY CONSTRUCTION PLASTER OR WOOD FINISH

the cost of insulation particularly when Eagle Mineral Wool Insulation is applied pneumatically.

When Eagle LT Felt is used it should be applied in two layers with vapor barrier between layers. Felt should be cut full allowing some slight compression in placing so that a firm, tight, secure fit will be made against studs.

WALLS

MASONRY CONSTRUCTION

In pneumatic application of Eagle Mineral Wool, the upper section of the wall should be left open when applying interior finish. Mineral Wool should then be blown flush and balance handpacked to ceiling. Inner finish can then be completed.

Plaster Finish

Over inner studs a layer of vapor permeable paper shall be placed under the ribbed galvanized metal lath. Although other laths may be also used, a ribbed lath will give added stiffness and add to the

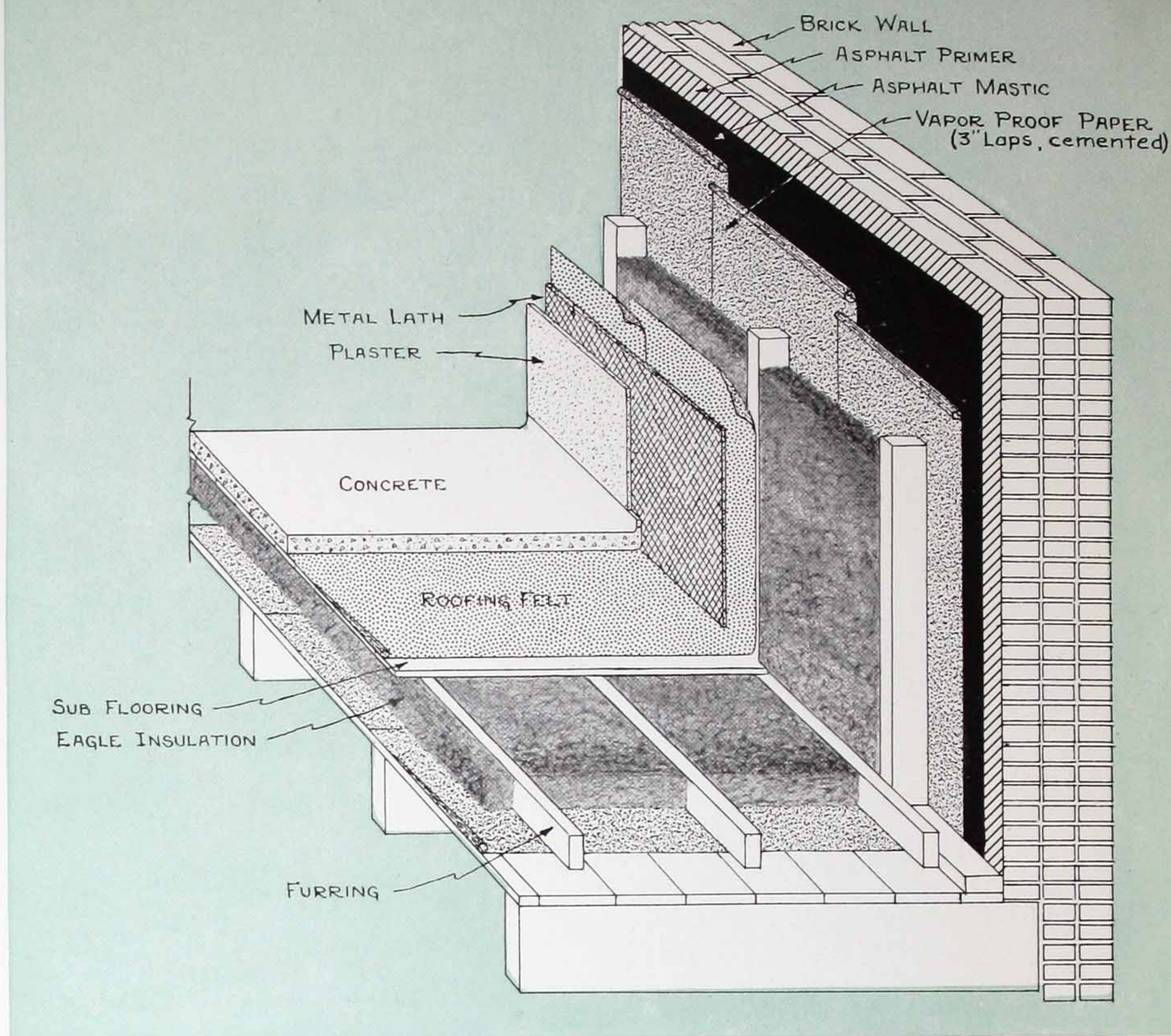


Fig 3 — Studs above are full wall thick; one-half thick studs are more efficient.

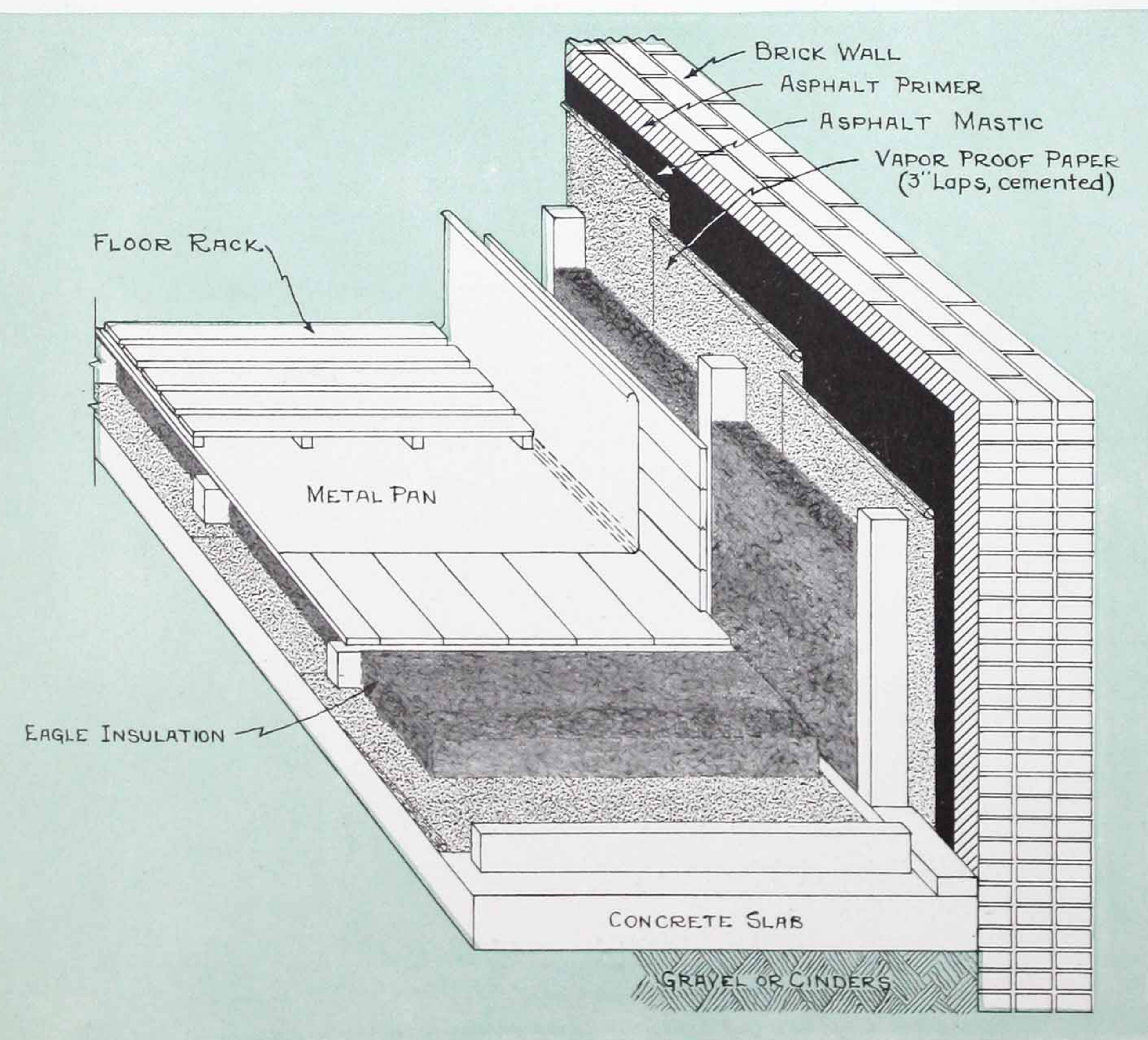


Fig 4 — T & G Sheathing and Flooring are used here in place of vapor permeable paper and metal lath.

finished appearance. The plaster is composed of one part Portland Cement to three parts clean screened sand and 8% hydrated lime. The plaster finish will be quite strong due to the steel mesh back, and cracking will be reduced to a minimum; however, some cracking may occur even when most expertly applied. Apply plaster in two coats, first coat $\frac{1}{4}$ " thick, and after this has thoroughly dried, apply second $\frac{1}{4}$ " coat, troweling to a smooth finish. It is customary to reduce cracking by scoring the second coat in 4' squares cutting to first coat.

Wood Finish

Where a wood interior finish is specified, it shall be constructed of clear fir Sheathing and Flooring applied directly over studs. Finish with one or more coats of clear shellac for protection.

WALLS

ALL WOOD CONSTRUCTION

All wood construction commercial refrigerators are most commonly built in sections at a manufacturer's plant, erected, fitted and finished, then knocked down, shipped and erected in final location. However, permanent erection is also done on job site and following method is used:

Erect 2" studs on 25" centers. Studs shall either be full wall thickness or one-half wall thickness. Erect vapor barrier by nailing vapor-proof paper to studs overlapping and sealing with asphaltic compound at joints. Use two layers when refrigerator operates below 32°F. and three layers when operating at 0°F. or below. Apply T & G Sheathing over vapor seal, using clear fir, spruce or oak.

When LT Felt is used, apply by wedging firmly between studs. For low temperature freezer it is best to use staggered studs, applying insulation in two layers with vapor seal between. In pneumatic application of Eagle Mineral Wool, several of the top boards in the wall should be left off for access to interior wall. Mineral Wool should be blown flush and balance hand packed to ceiling. Vapor barrier and finish boards should then be applied to finish interior. Finish interior with T & G fir or spruce with one or more coats of clear shellac for protection.

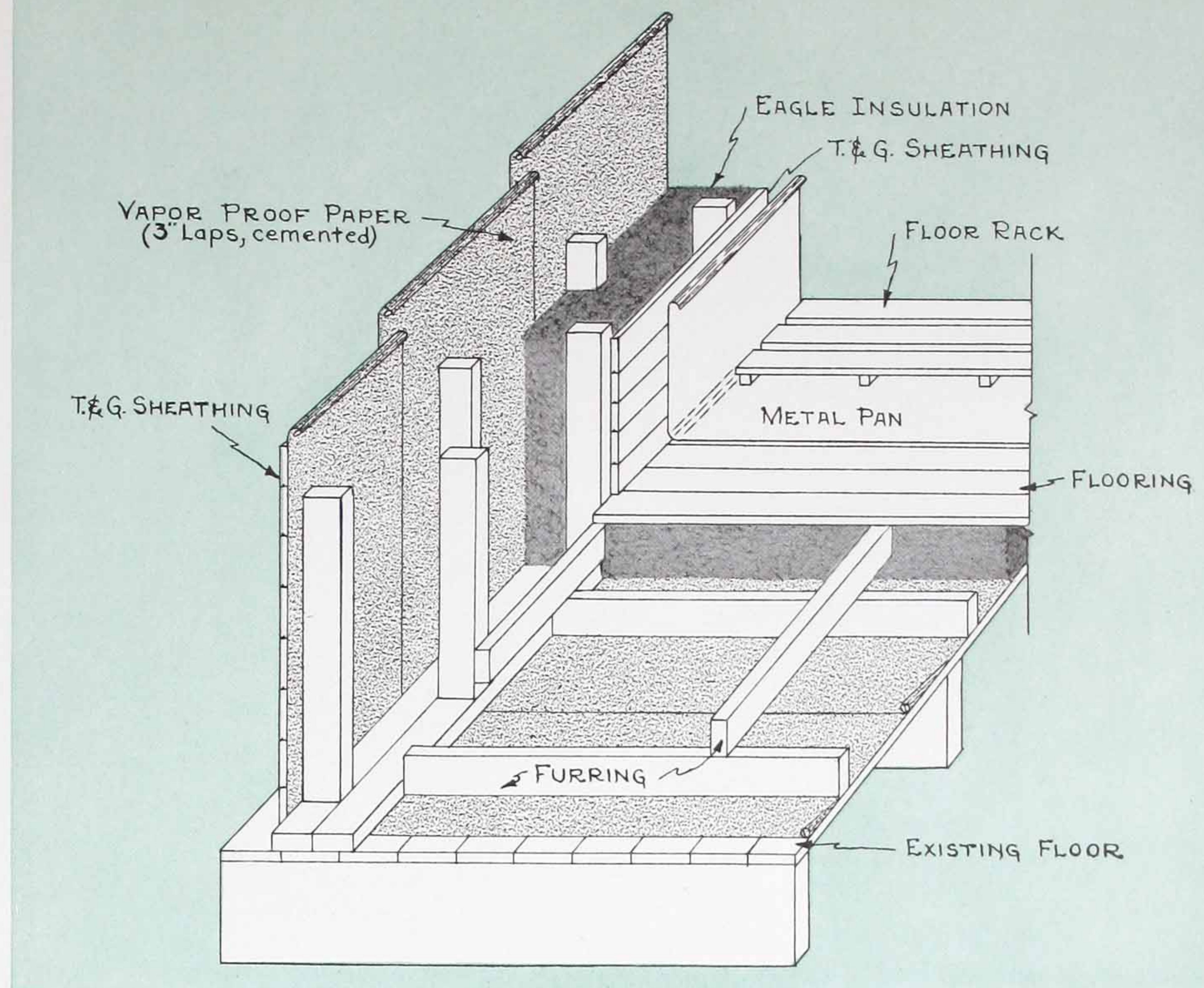


Fig. 5 — One-half wall thickness studs increase labor costs somewhat but also increase efficiency.

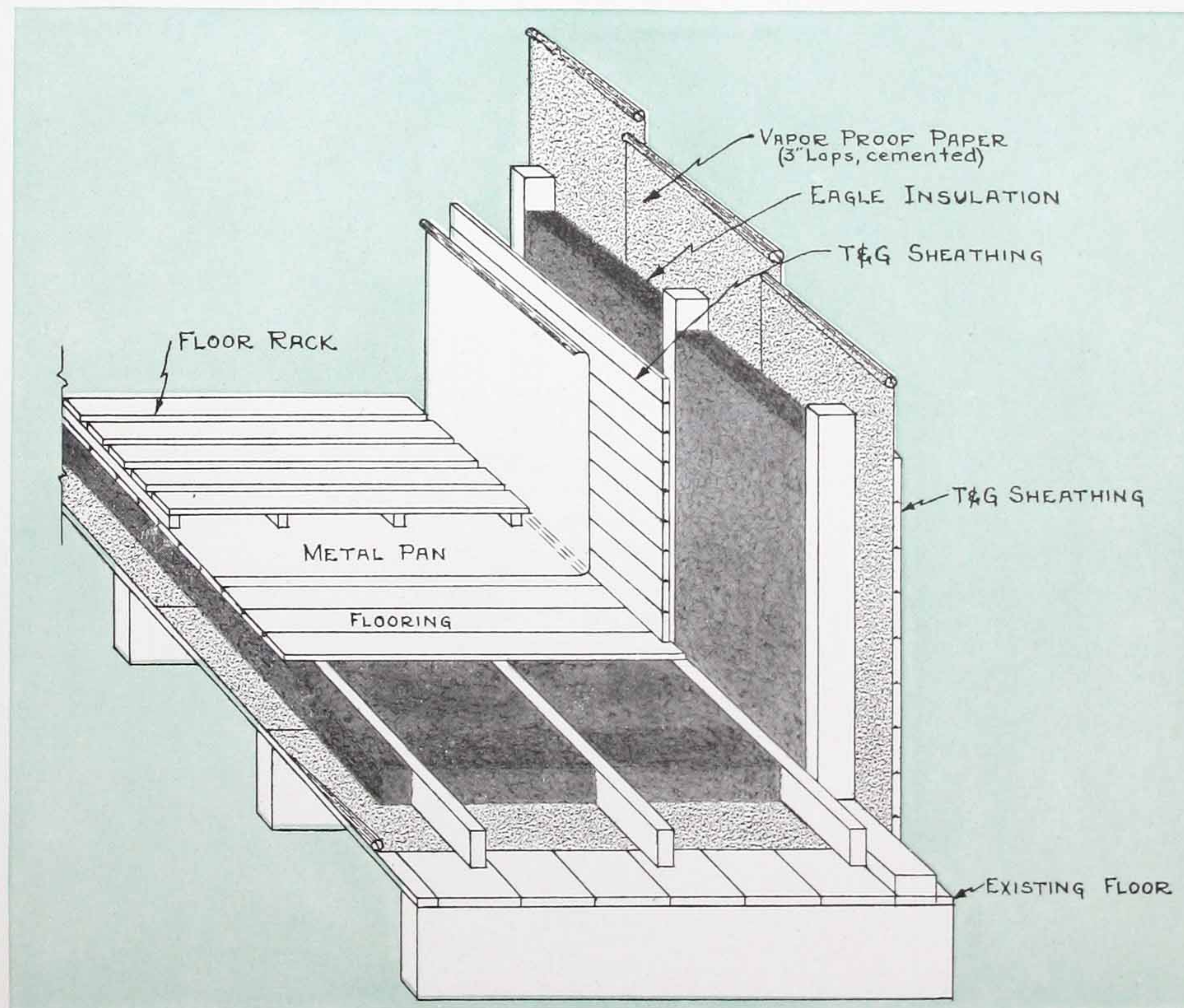


Fig. 6 — One layer of vapor-proof paper is considered sufficient at temperatures above 32°F.

CEILINGS

The ceiling of a refrigerator is a most important part, particularly in cases of flat roof construction where the insulation is applied directly under the roof. In this case particular care should be taken in making the vapor seal, and an additional inch or two of insulation is to be highly recommended. See Figures #7 and #8 for construction details.

In insulating ceiling, never leave an unventilated space above. (See Fig. #9.) If roof is being built over refrigerator in case of outdoor installation, ventilate space between roof and top of refrigerator. Refrigerators built indoors without outdoor exposed walls, generally give better service both from a refrigeration and insulation standpoint.

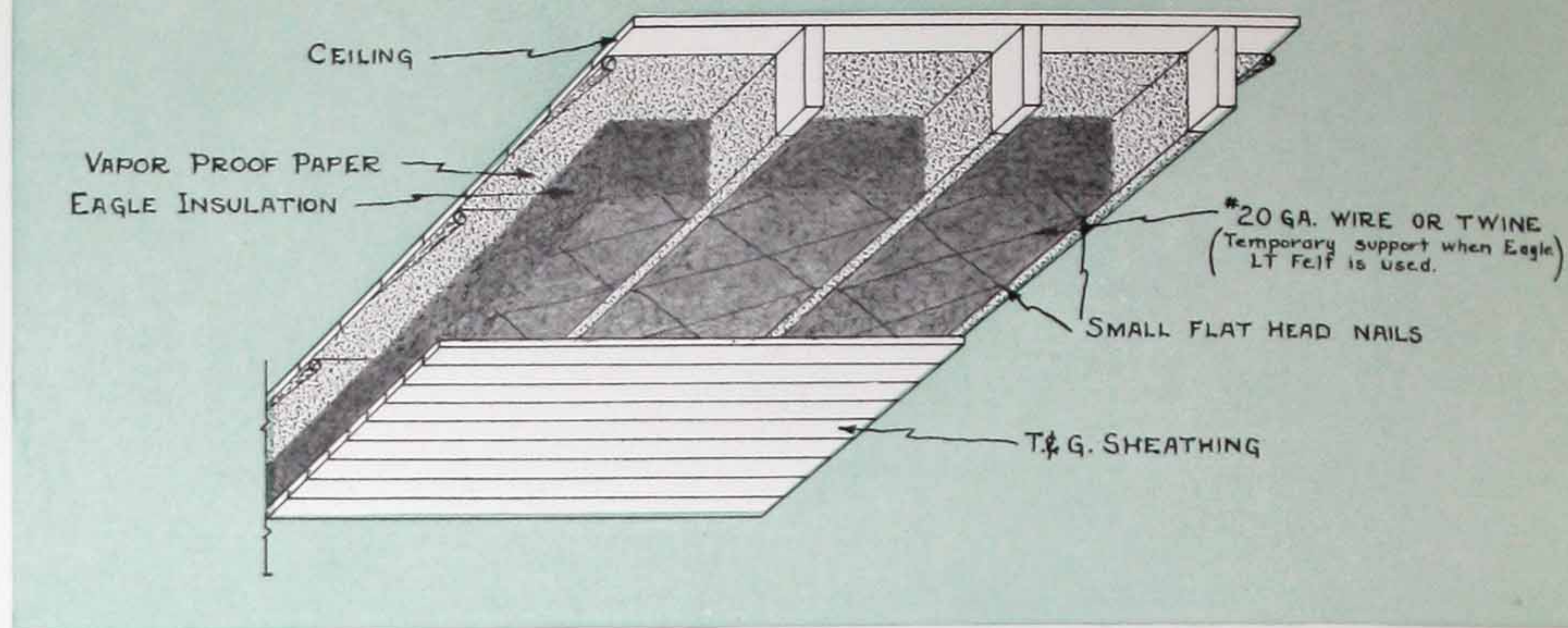


Fig. 7 — Details of refrigerator ceiling when wood finish is desired.

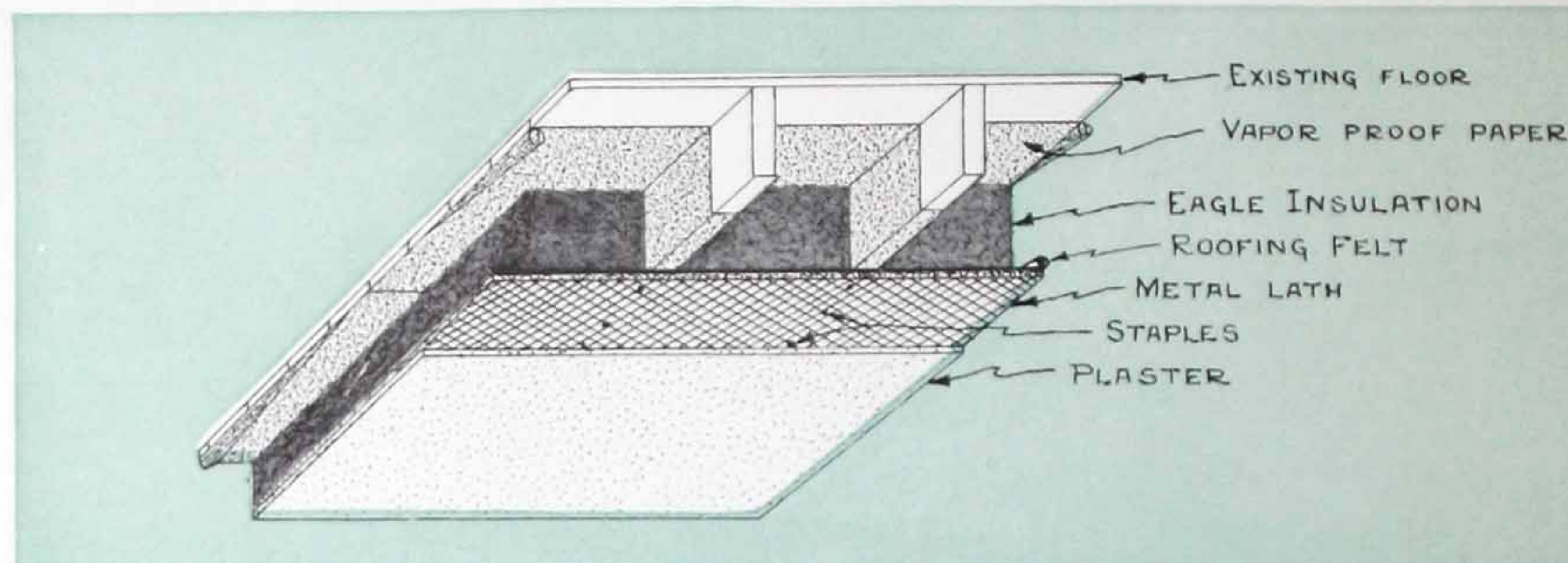


Fig. 8 — Details of application of Eagle Insulation to existing ceiling.

In applying LT Felt to ceiling joists, apply in layers 3" thick or more, wedged between joists or sleepers. Hold in place by driving small flat head nails on staggered centers into joists and then weave suitable weight twine or light gauge wire across from nail to nail. Eagle LT Felt should fill joists or sleepers so that no air space exists either above or below insulation. Finish same as side wall construction.

In blowing Eagle Mineral Wool from above joists, when feasible, interior ceiling should be completed first, and exterior applied after insulation is blown. Insulation should fill joist space and be levelled off slightly above so that Mineral Wool will be compressed when finish is applied.

Where there is already flooring above ceiling, vapor barrier should first be applied from below and then interior finish should be applied with provisions for blowing made within six feet of side walls and every twelve feet thereafter, blown in both directions so that maximum blow will be six feet. Entire space in ceiling must be filled. Access openings may be hand packed, and finish applied.

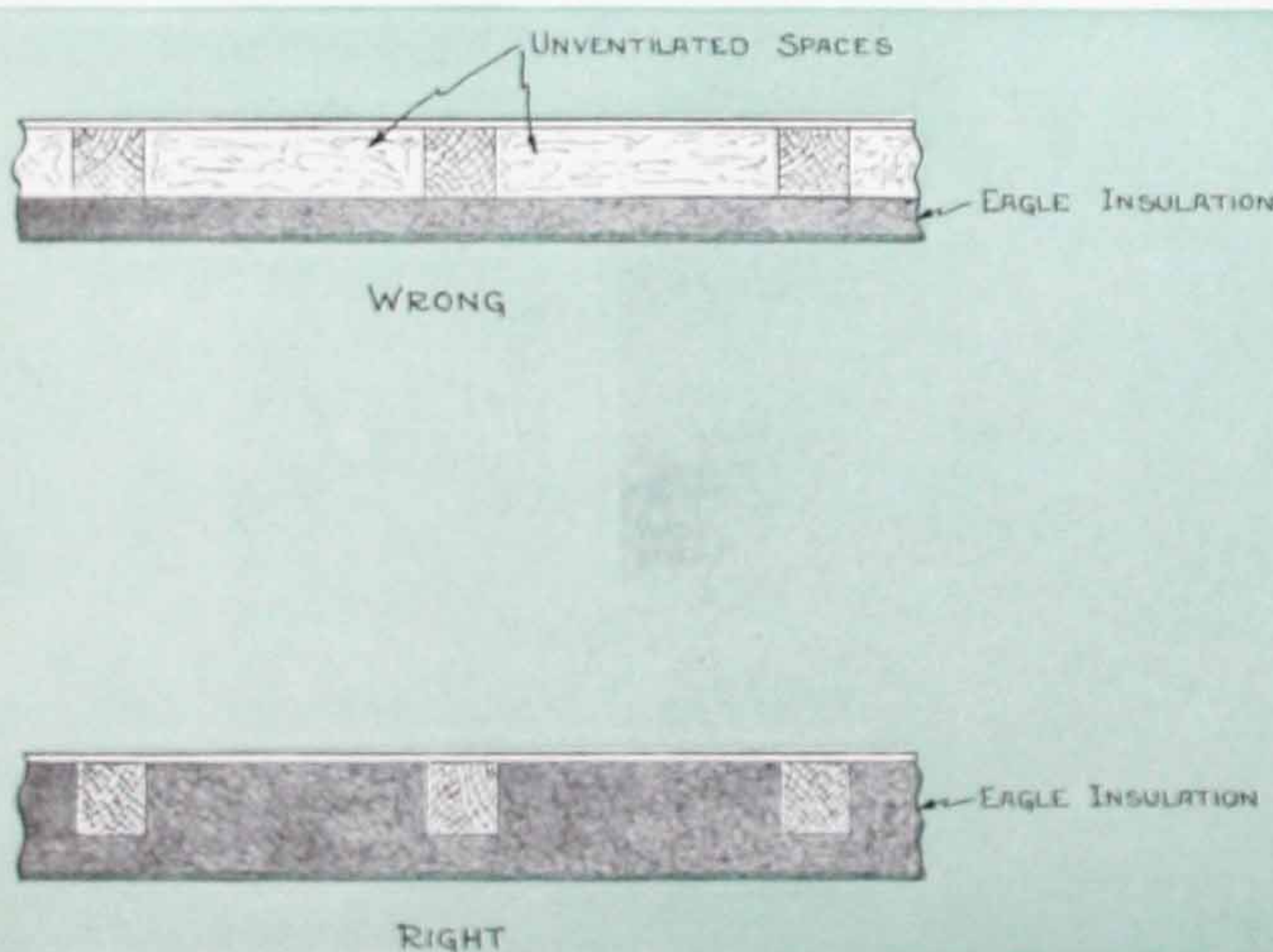


Fig. 9 — Unventilated spaces should never be left over insulation in ceiling.

FLOORS

For general purpose refrigerators such as butcher, restaurant, hotel, florist, dairy, beer, etc., operating above freezing temperatures, some provision should be made for drainage and hosing out.

Waterproof concrete floor should slope 1" in 10' to trapped floor drain. On wooden floors, cover with heavy gauge galvanized copper bearing steel sheet flashed 30" up on side walls with all joints soldered water tight and trapped floor drain installed. Cover entire floor with slatted type hardwood floor rack. See Figs. 10 and 11 for floor details.

Eagle Mineral Wool should be installed in the floor to a point slightly above the sleepers so that when the flooring is laid the mineral wool will be slightly compressed.

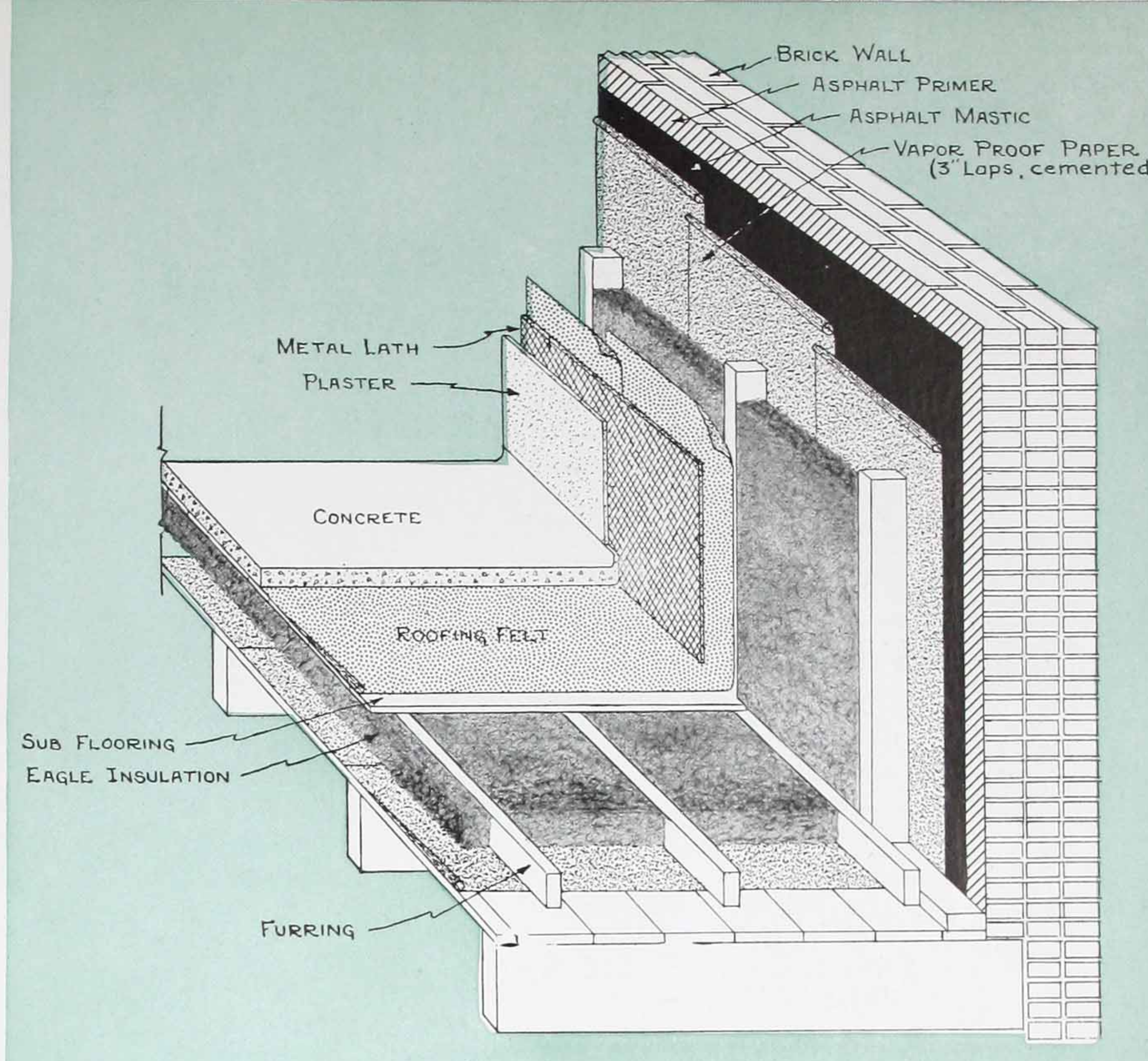


Fig. 10 — Concrete floor of general purpose refrigerators should slope 1" in 10'.

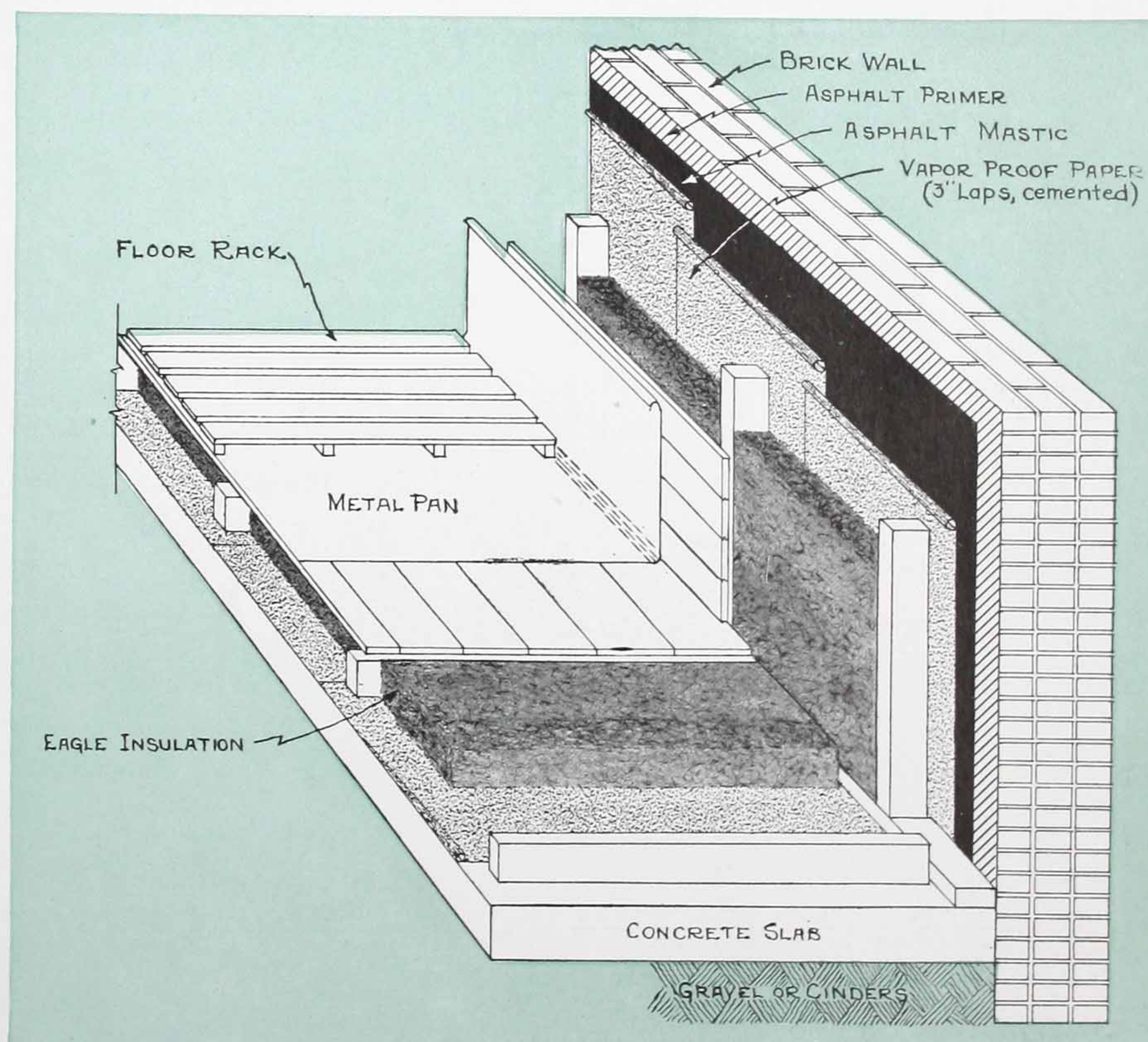


Fig. 11 — Heavy gauge galvanized copper bearing steel sheet recommended for wooden floors

BUNKERS

Although the modern trend toward blower type coils and self-contained metal drip pans has practically eliminated wooden bunkers, there are still times when these may be specified.

Proper design is most important. The following general rules apply to construction:

- A** The baffling must be of correct design and properly proportioned and located.
- B** The bunker must be properly insulated.
- C** The bunker pan must be sloped sufficiently to obtain the desired air movement and drainage of condensation from coils.

An approved vertical baffle and bunker pan construction is shown in figure #12. Spruce or maple is recommended for bunker construction; pine should never be used as it gives off an odor which is absorbed by the food. All wood should be given two coats of odorless, clear shellac in order to protect the wood and make it as waterproof as possible. The shellac should be allowed to dry before the wood is placed in the cooler.

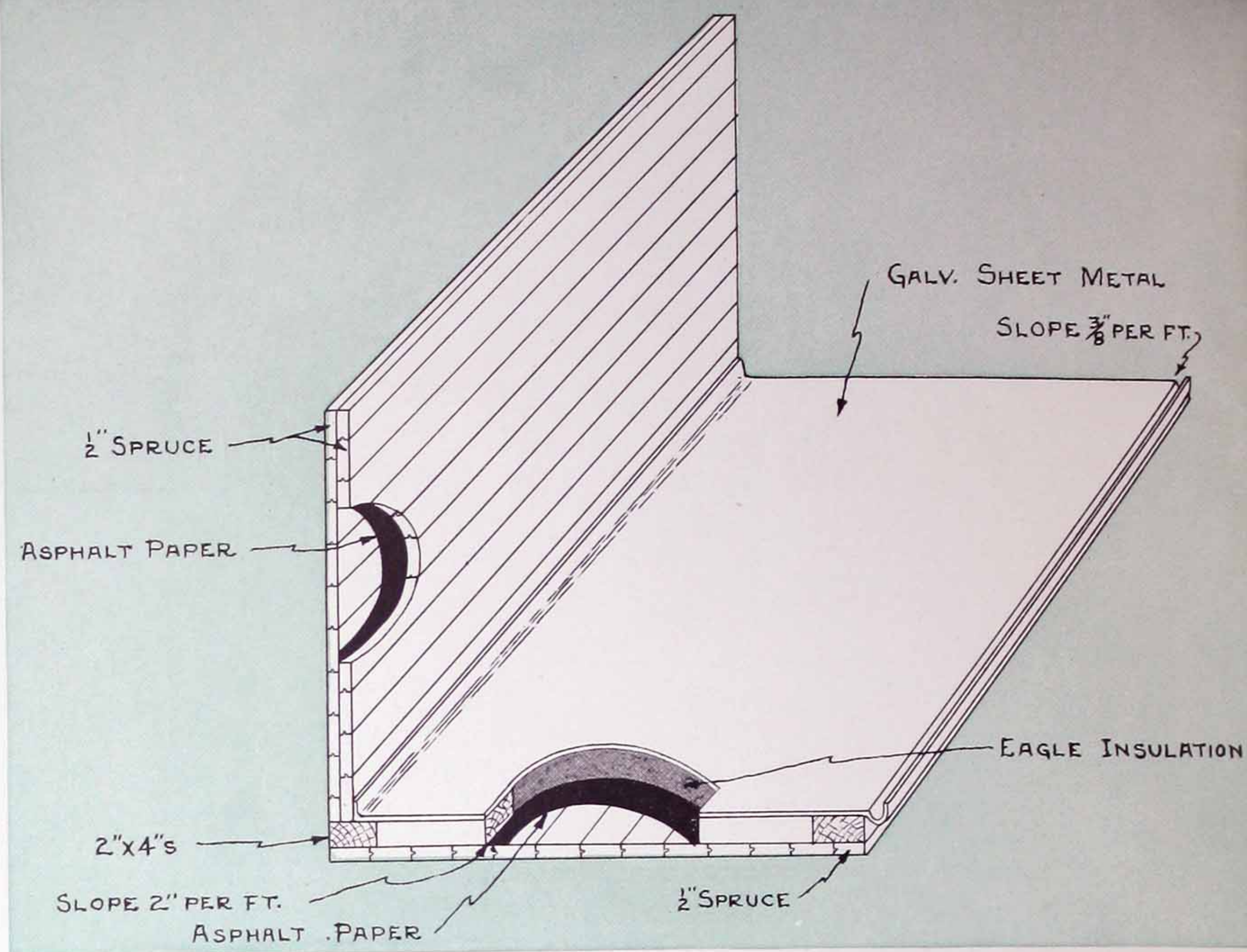
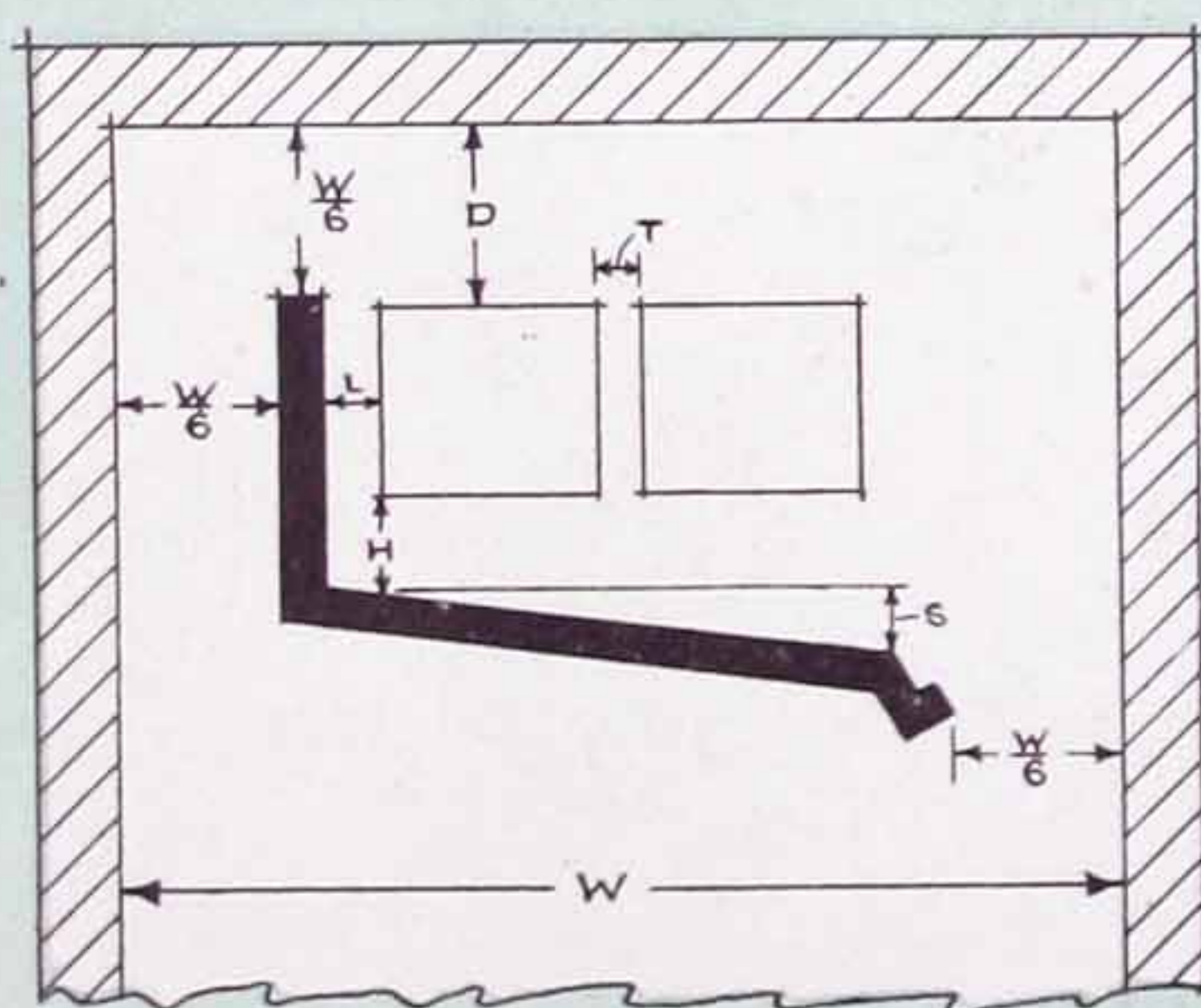


Fig. 12 — Example of an approved vertical baffle and bunker pan.

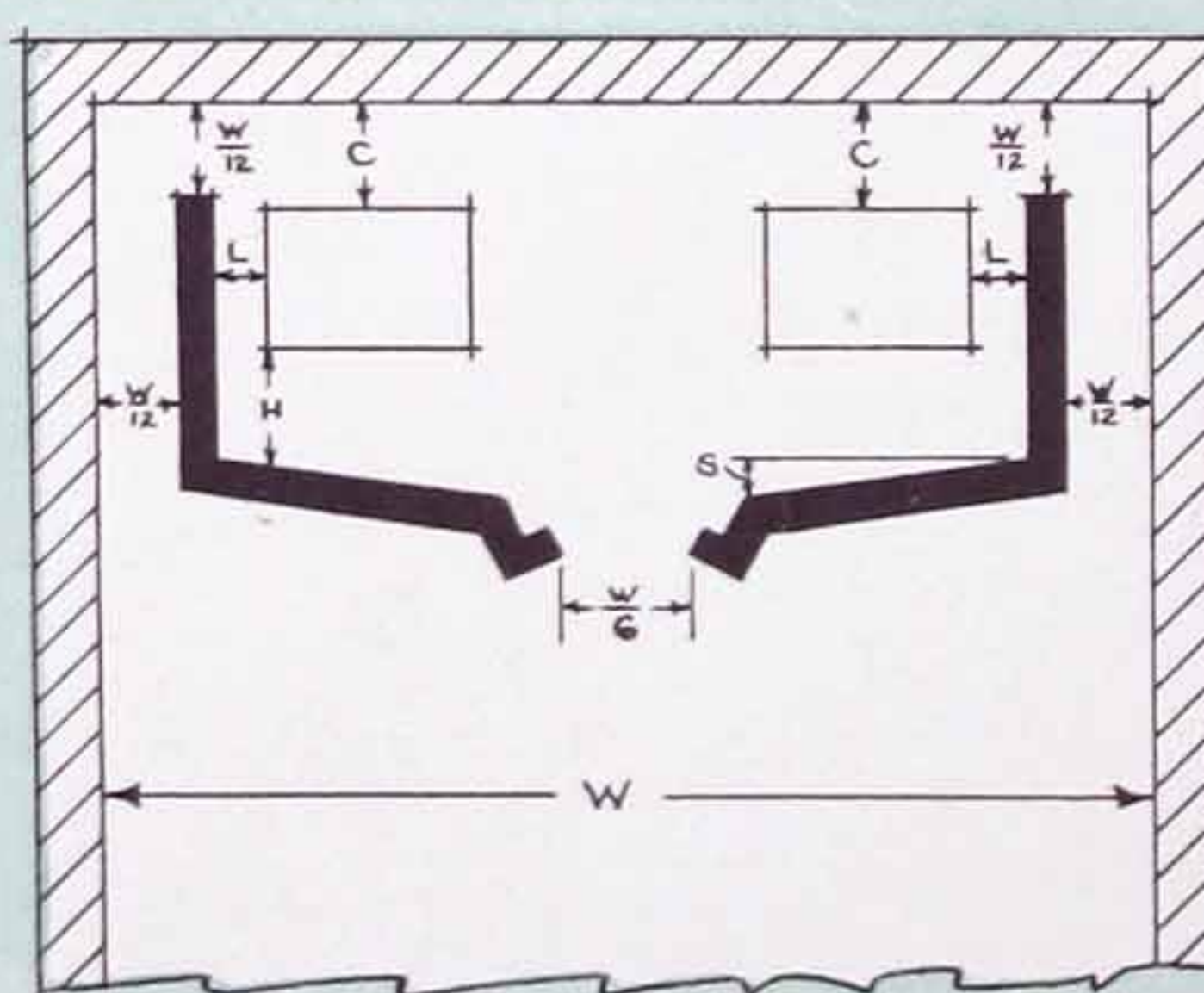
The bunker pan should slope at least 1 in./foot toward the drain trough, and if there is sufficient room it is recommended that the slope be increased to 2 in./foot. The galvanized sheet metal of the bunker pan is nailed in place with galvanized nails. All nail heads must be soldered or covered with asphalt to prevent leakage of moisture into the insulation and also rusting of the nail heads. Lap joints should be either soldered or double seamed.



W—INSIDE WIDTH OF COOLER
S—SLOPE 2" PER FOOT
H—6" MINIMUM
L—2" TO 6"
D— $\frac{W}{6} + \frac{1}{2}$ "
T—1" MINIMUM

PROPORTIONS OF L TYPE BUNKER

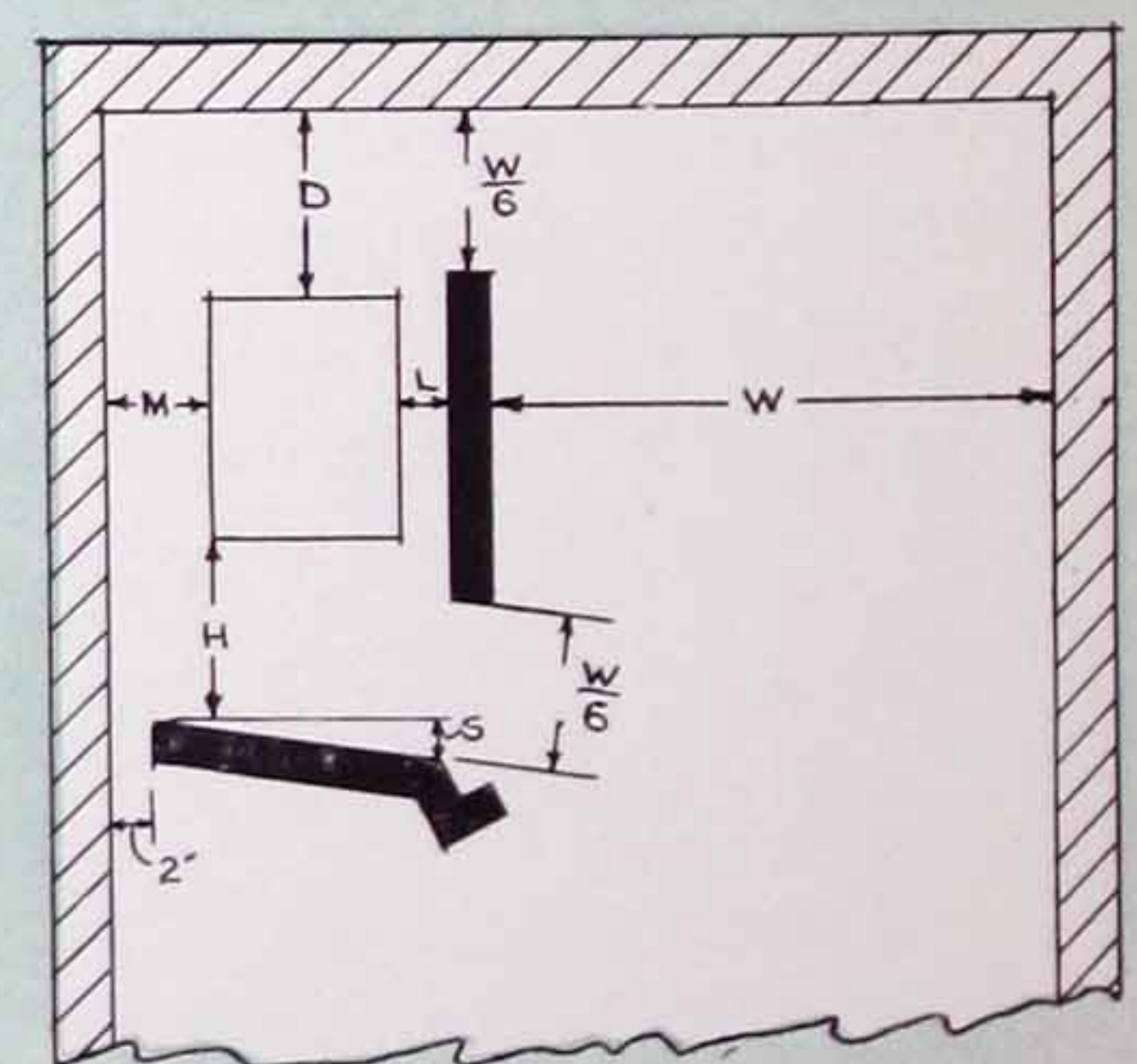
(TO BE USED WHEN INSIDE WIDTH OF COOLER DOES NOT EXCEED 5'-0".)



W—INSIDE WIDTH OF COOLER
S—SLOPE 2" PER FOOT
H—6" MINIMUM
L—2" TO 6"
C— $\frac{W}{12} + \frac{1}{2}$ "
D— $\frac{W}{6} + \frac{1}{2}$ "

PROPORTIONS OF U TYPE BUNKER

(TO BE USED WHEN INSIDE WIDTH OF COOLER IS IN EXCESS OF 5'-0".)



W—DISTANCE FROM VERTICAL BAFFLE TO OPPOSITE WALL OF COOLER
S—SLOPE 2" PER FOOT.
H—6" MINIMUM
M—4" MINIMUM
L—2" TO 6"
D— $\frac{W}{6} + \frac{1}{2}$ "

PROPORTIONS OF SIDE TYPE BUNKER

(TO BE USED ONLY WHEN INSIDE WIDTH OF COOLER DOES NOT EXCEED 5'-0".)

The above three drawings illustrate some of the most common types of bunkers.

GENERAL RECOMMENDATIONS

Refrigerator Doors

The manufacture of refrigerator and freezer doors is a specialty and should not be attempted by the average carpenter or cabinet maker. Refrigerator doors can be purchased from any one of a number of standard manufacturers. We recommend that in all cases this be done.

Refrigerator doors are generally shipped unfinished, and should be painted or finished to match the refrigerator itself to prevent warping and distortion which will otherwise occur.

Do not attempt to use standard refrigerator doors in freezers. Be sure to specify freezer doors if temperatures are below 32°F.

Manufacturers of refrigerator doors will supply you with complete details on building the necessary framework for these doors, and their instructions should be carefully followed.

Refrigerator Hardware

In ordering door hinges and latches, follow the recommendations of the manufacturer of the hardware, giving weight and dimensions of door if available. Never use hardware that is too light; it is much better to have extra heavy hardware than that which is inclined to give under service. As a safety factor, always install door latch with internal release.

Refrigerator Interior Lighting

Refrigerator interior lighting should be sufficient to provide good illumination for all parts of the storage spaces, and arrangements should be made for installing the wiring and fixtures when refrigerator is under construction. Lights should be controlled by an external toggle switch beside the door with a pilot light to indicate when the lights are on.

Door Plate

For heavy service refrigerators a steel door plate should be provided. This is particularly true for beer storage, or for refrigerators where barrels, etc., will be rolled into the refrigerator. If the floor level of the refrigerator is above the main floor, a steel inclined plate should be provided as well as a steel plate over the door sill.

Walls

Insulation of hollows in new or existing walls without proper vapor-proof protection is not recommended when spaces so insulated are to be carried at refrigerator temperatures.

If refrigerator is constructed in the shop in sections and assembled at job site, pneumatically applied insulation should be installed in the field at time of erection.

When existing walls are to be used as a refrigerator wall, siding should be removed and a double layer of vapor-proof paper applied over sheathing, then siding replaced. Vapor barrier must be continuous and joints sealed as previously described. Carry vapor barrier over to join ceiling and floor seals.

Building Support Columns

Columns within a refrigerated space shall be insulated to the same thickness as sidewalls with same vapor barrier protection.

Beams

Insulate around beams. Do not create a dead air space by leveling off under beams as this will lead to condensation troubles. Insulate over all heat conductors extending through walls if these cannot be removed.

Sprinkler Systems

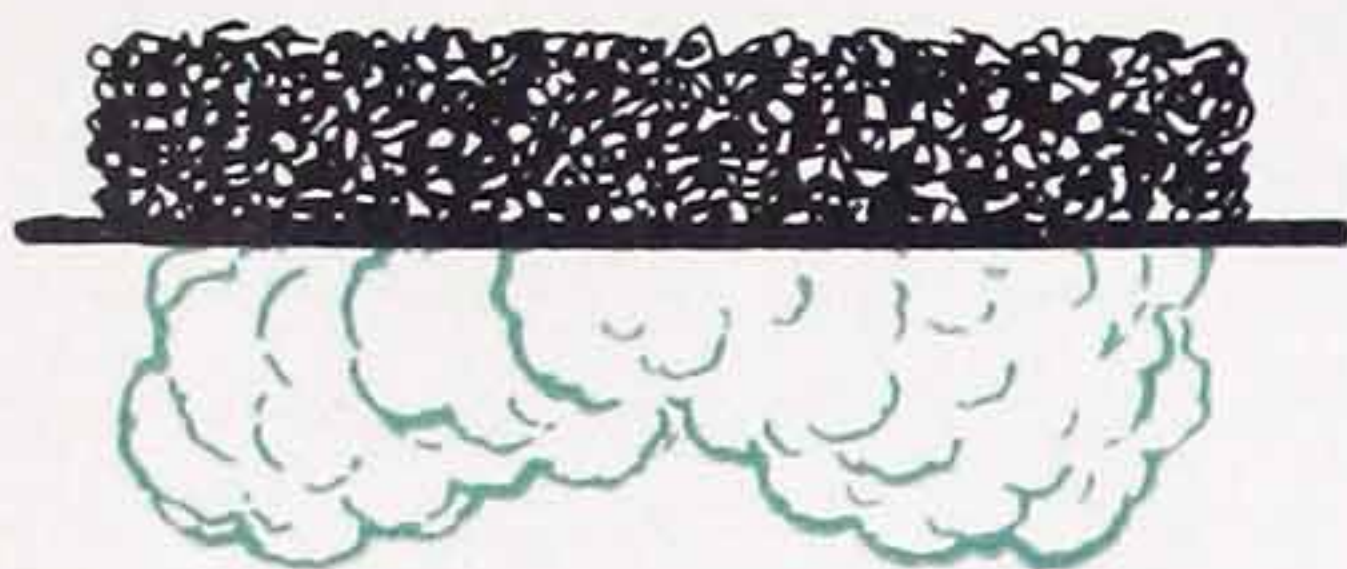
Do not include a wet sprinkler system in any refrigerator, particularly a freezer. Lower ceiling height of refrigerator so that sprinklers will be outside.

Never leave sprinkler or water pipes between insulation and outside temperatures unless they are suitably protected against freezing. Re-locate pipes, if necessary, to place where temperatures are always above freezing.

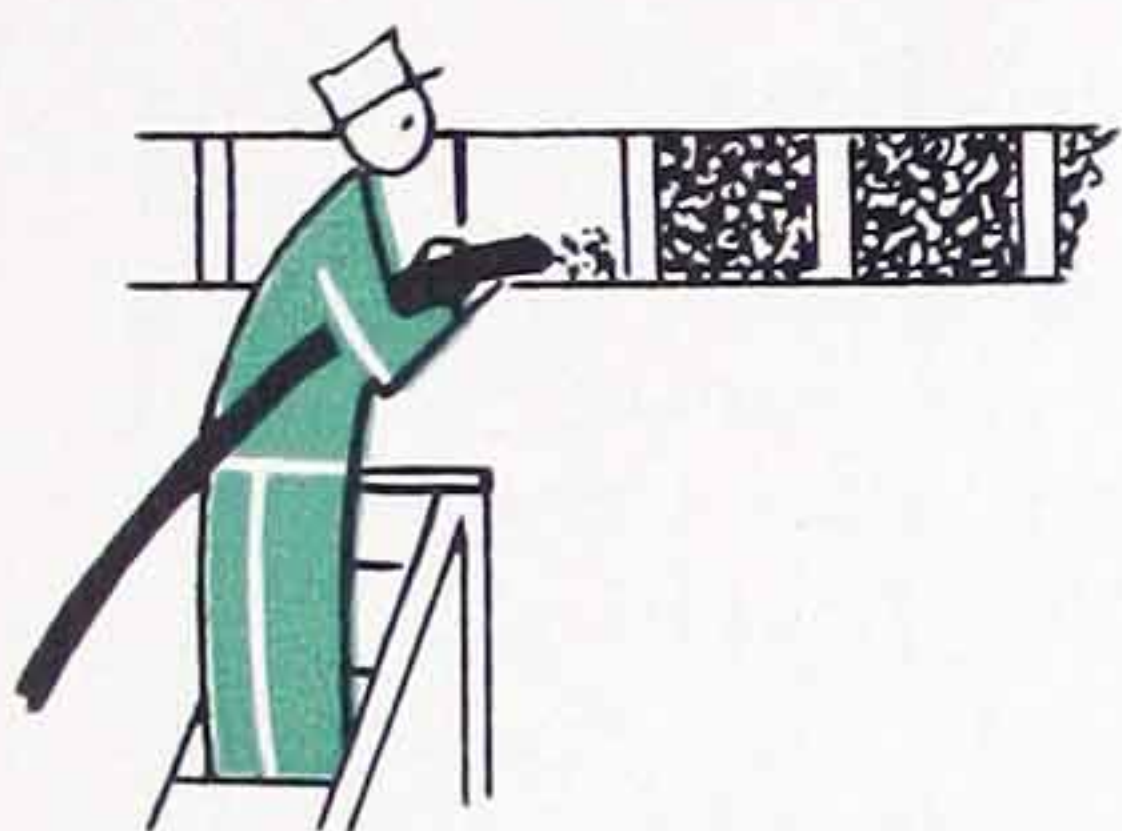
Wood for Studs, Sleepers, Etc.

All studding, sleepers, and joists should be ripped full thickness and should be from selected well-seasoned lumber, free from odors. For permanent construction, wood should be rot and vermin proofed by treatment with chromated zinc chloride under pressure of 3# Cu. Ft., or other suitable method. If fireproofing is desired, similar treatment under higher pressure is reputed to be quite effective.

THE IMPORTANCE OF QUALITY WORK



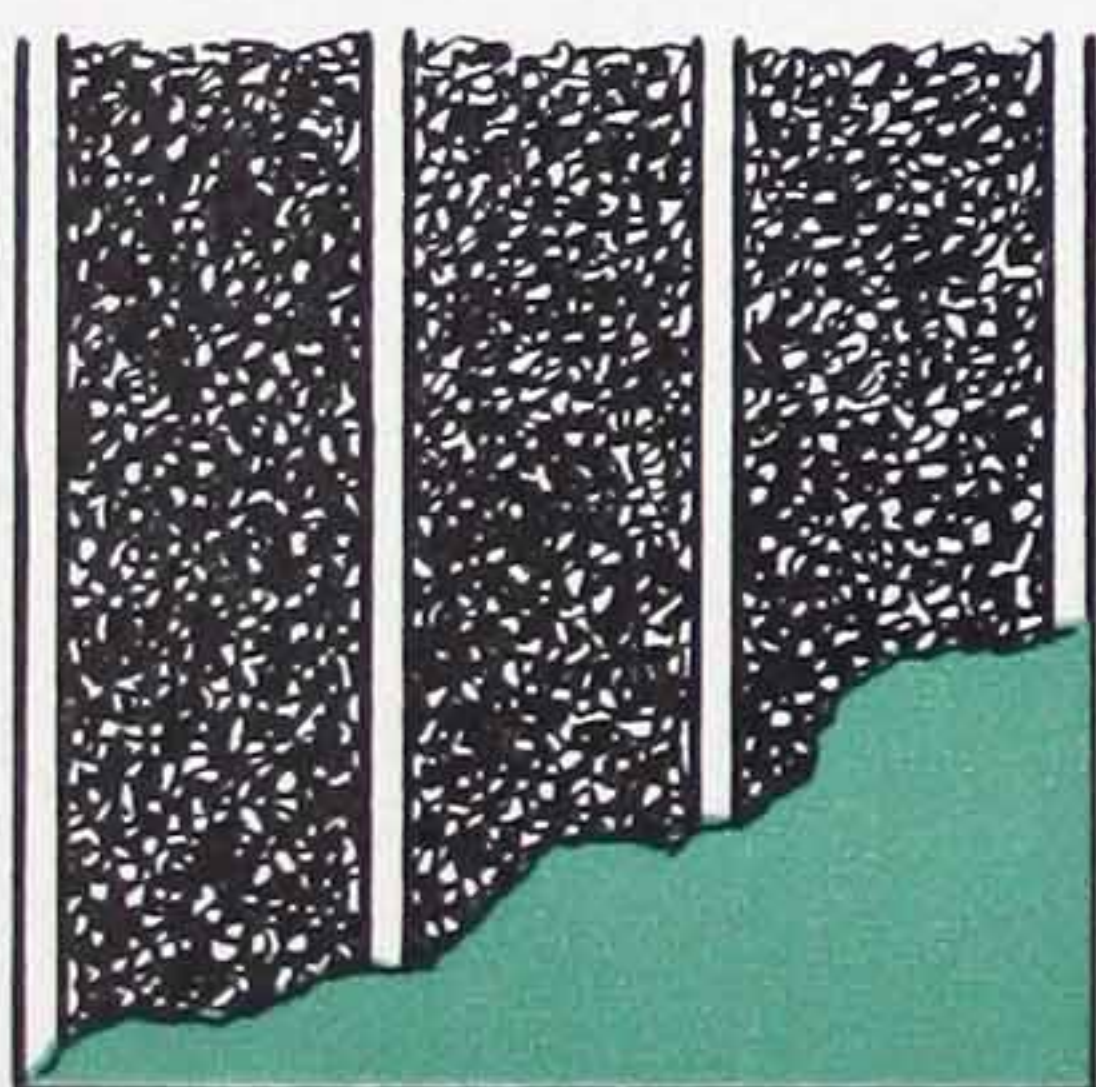
**COMPLETE
VAPOR-PROOFING**



TRAINED APPLICATORS



RIGID SPECIFICATIONS



NO VOIDS



APPROVED MATERIALS

The U. S. Bureau of Mines states "Insulation is no better than the man who installs it." And the skill of the craftsman who installs insulation for low temperature work is only as good as his ability and care in making a complete vapor barrier. The men who install Eagle Insulation take every precaution to see that the vapor barrier they install provides the tight, secure seal so vital to satisfactory operation and long life of the cold room.


You can depend upon Eagle Insulators to do a thorough job at all times, whether it be large or small. These applicators are trained craftsmen with many years of experience and specialization in the low temperature insulation field. This experience and the most modern methods they use can save you considerable money in lower construction costs and in decreased maintenance charges.

To a great extent the economy and life expectancy of a refrigerated room will depend on the skill of the applicator and his faithfulness in following exactly modern, rigid specifications, such as those developed by the Eagle-Picher Engineering Department, and shown on previous pages.

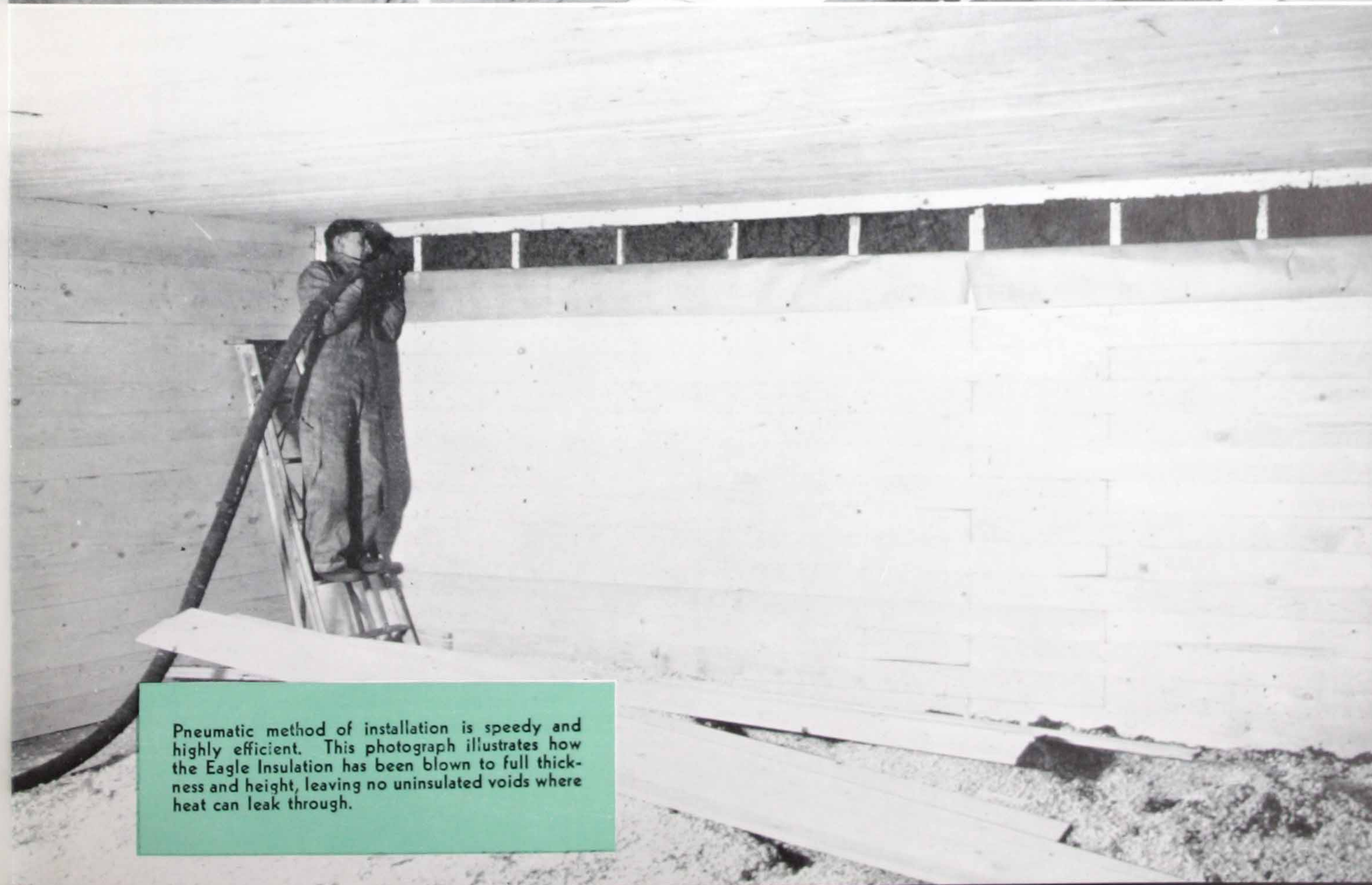
Void spaces in the insulation must be eliminated. Edges of formed insulation must butt together. The vapor barrier must be adequate and complete. It is these factors and others of comparable importance which governed the writing of the rigid Eagle-Picher specifications appearing in this book.

**Quality Insulation Deserves Quality Workman-
ship In Applying It For Maximum Efficiency**

M A N S H I P



Neat appearance of Eagle LT Felt before application of interior finish will be matched by its long years of steady, heat-stopping service. The "dead air" cell structure of Eagle LT Felt not only adds to its efficiency but insures exceptional light weight, making the product easy to handle and install. It can easily be cut to any desired length.



Pneumatic method of installation is speedy and highly efficient. This photograph illustrates how the Eagle Insulation has been blown to full thickness and height, leaving no uninsulated voids where heat can leak through.

STORAGE TEMPERATURES

AND HUMIDITY RANGES FOR FOOD AND MISCELLANEOUS PRODUCTS

Since it has been proved that products, once frozen will not keep indefinitely even though below-freezing temperatures are maintained, the trend has been toward lower, faster freezing temperatures as well as lower storage temperatures. Frozen products should be kept at or below 0°F. if they are to be stored for any greatly prolonged period of time. After a time, higher temperatures permit enzyme activity. Fluctuations in temperature promote growth of large ice crystals which damage the texture and appearance of products.

The chart, on pages 24 and 25, shows the actual temperatures and humidities most desirable for the

storage of various food and non-food products, both for short-time and long-time storage. Proper temperature, far from being the only factor to consider in the storage of food, is of lesser importance than humidity at temperatures above freezing. For instance, if meat is stored at too low a humidity, drying out will occur, resulting in a loss to the butcher who sells by weight. If too high a humidity is allowed, the meat will slime, necessitating costly trimming.

Air movement is also of some importance. There are food products which require air movement, while other miscellaneous products, such as certain flowers, are damaged by it.

PROPER STORAGE TEMPERATURE AND HUMIDITY

NOTE:— FOR FROZEN STORAGE, temperatures should be maintained at zero or below for all foods.

PRODUCT	SHORT TIME STORAGE		LONG TIME STORAGE		PRODUCT	SHORT TIME STORAGE		LONG TIME STORAGE	
	Temperature F.	Relative Humidity	Temperature F.	Relative Humidity		Temperature F.	Relative Humidity	Temperature F.	Relative Humidity
Vegetables:					Vegetables: (Cont'd)				
Artichokes.....	40-45	80-85	38	80-85	Mushrooms.....	50-60	80-85	32-34	80-85
Asparagus.....	36-45	80-85	32-34	80-85	Onions.....	40-50	80-85	32	70-75
Beans, Lima.....	36-45	80-85	32-35	80-85	Parsnips.....	40-50	80-85	32	90-95
“ String.....	36-45	80-85	32-34	80-85	Peas, Green.....	40-45	80-85	32	85-90
“ Dried.....	40-45	65-70	40-45	65-70	“ Dried.....	40-45	65-70	40	65-70
Beets.....	40-45	80-85	32-37	85-90	Peppers.....	36-45	80-85	32	85-90
Broccoli.....	40-45	80-85	32-37	80-85	Potatoes, Irish.....	36-45	80-85	36-50	85-90
Brussels Sprouts.....	40-45	80-85	32-37	80-85	“ Sweet.....	50-60	70-75	50-55	80-85
Cabbage.....	36-45	80-85	32	90-95	Pumpkin.....	55-60	70-75	55-60	70-75
Carrots.....	36-45	80-85	32	90-95	Radishes.....	40-45	80-85	32	90-95
Cauliflower.....	36-45	80-85	32	85-90	Rhubarb.....	36-45	80-85	32	90-95
Celery.....	40-45	80-85	31-33	90-95	Sauerkraut.....	36-45	80-85	..	..
Corn, Green.....	40-45	80-85	31-32	85-90	Spinach.....	40-45	80-85	32	90-95
“ Dried.....	40-45	65-70	40-45	65-70	Squash.....	55-60	70-75	55-60	70-75
Cucumbers.....	50-60	80-85	50-60	80-85	Tomatoes.....	50-55	80-85	50-55	80-85
Eggplant.....	50-60	80-85	50-60	85-90	Turnips.....	36-45	80-85	32	90-95
Endive.....	45-50	80-85	32	90-95					
Lettuce.....	36-45	80-85	32	90-95					

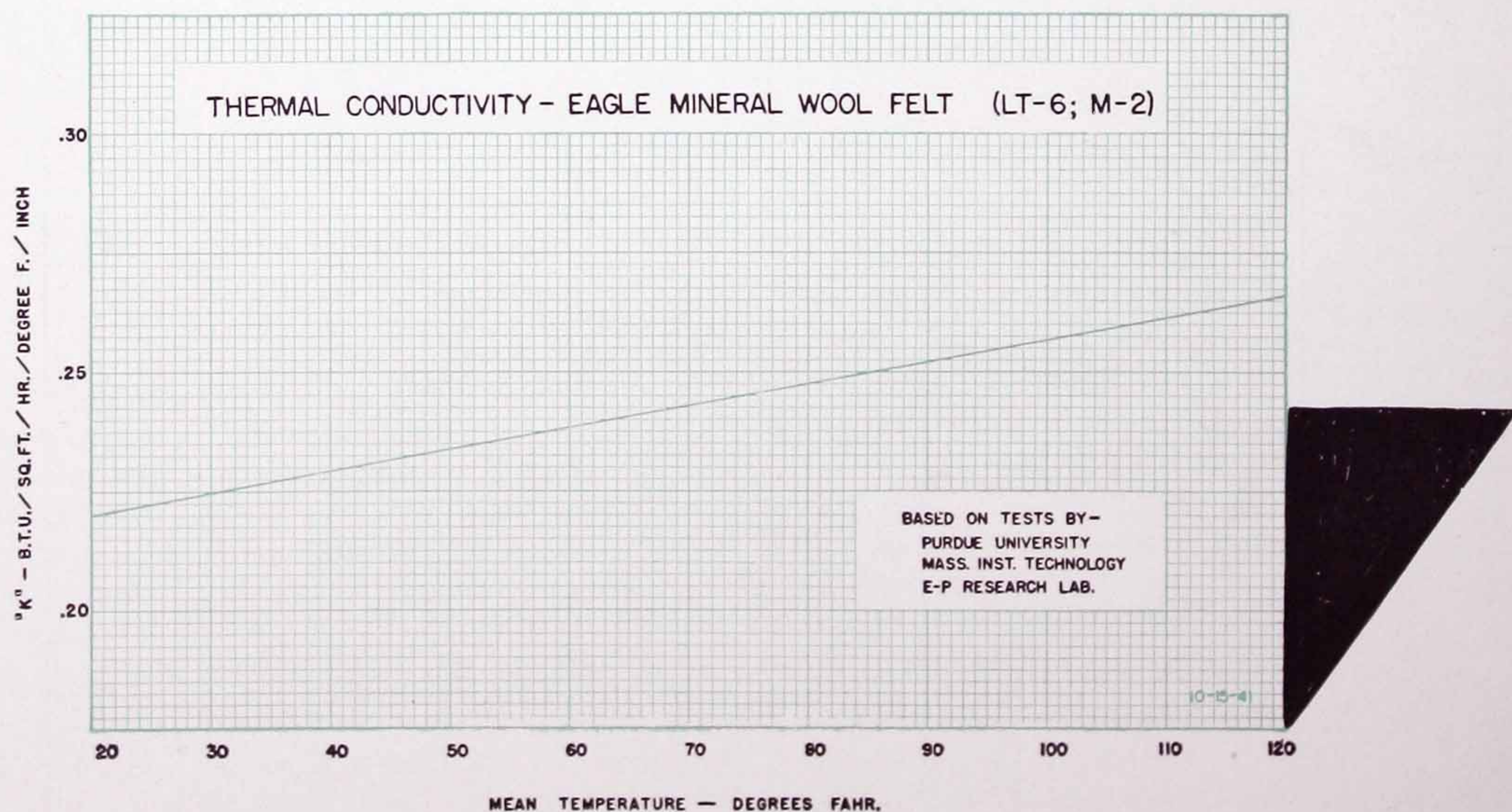
PROPER STORAGE TEMPERATURES AND HUMIDITY

NOTE: — FOR FROZEN STORAGE, temperatures should be maintained at zero or below for all foods.

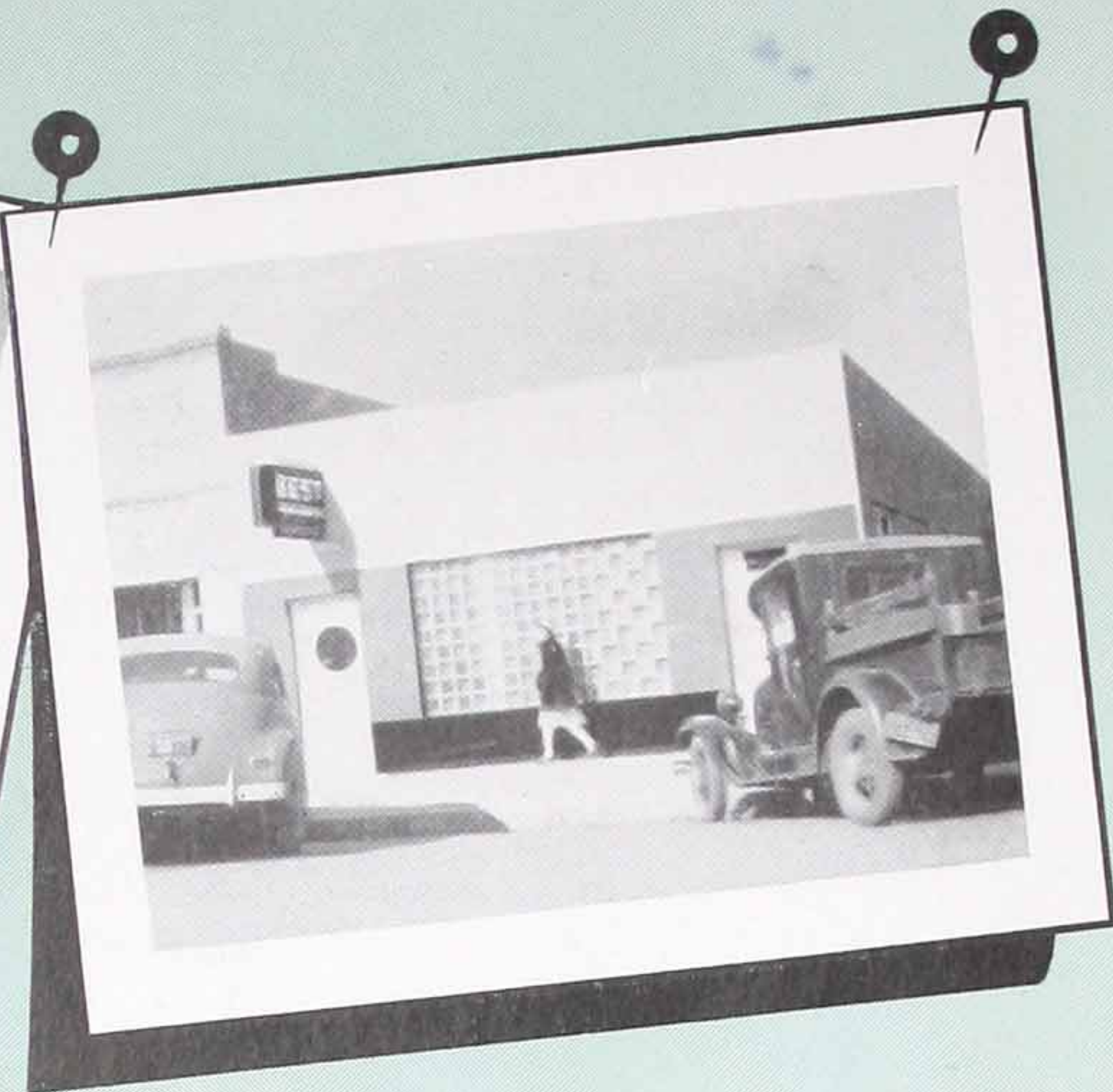
PRODUCT	SHORT TIME STORAGE		LONG TIME STORAGE		PRODUCT	SHORT TIME STORAGE		LONG TIME STORAGE	
	Temperature F.	Relative Humidity	Temperature F.	Relative Humidity		Temperature F.	Relative Humidity	Temperature F.	Relative Humidity
Meats, Fish, and Poultry:					Fruits: (Cont'd)				
Bacon.....	36-40	80-85	30-32	65-70	Grapefruit.....	36-45	80-85	32	85-90
Beef, fresh, lean.....	36-40	80-85	32-36	80-85	Grapes.....	36-45	80-85	30-32	80-85
“ “ fat.....	36-40	80-85	32-36	80-85	Gooseberries.....	40-45	80-85	32-34	85-90
“ dried.....	36-40	65-70	32-36	65-70	Lemons.....	50-55	80-85	50-55	80-85
Canned Meats.....	36-40	..	..	..	Melons.....	36-45	80-85	36-45	80-85
Fish, Fresh.....	34-36	90-95	25-30	90-95	Oranges.....	36-45	80-85	32	80-85
“ Dried.....	34-36	65-70	..	..	Peaches.....	36-45	80-85	31-32	80-85
Game, Fresh.....	34-36	80-85	32-36	80-85	Pears.....	36-45	80-85	31-32	85-90
“ Frozen.....	20-25	..	20-25	..	Persimmons.....	..	..	32-34	80-85
Hams, Fresh.....	36-40	80-85	32-36	80-85	Pineapple.....	36-45	80-85	..	..
“ Smoked.....	40-50	65-70	32-40	65-70	Plums.....	36-45	80-85	31-32	85-90
Lamb.....	36-40	80-85	32-36	80-85	Quinces.....	36-45	80-85	32-34	80-85
Lard.....	36-40	80-85	32-34	80-85	Raisins, Dried.....	36-45	80-85	34-36	80-85
Liver, Fresh.....	36-40	80-85	32-34	80-85	Raspberries.....	36-45	80-85	31-32	80-85
Mutton, Fresh.....	36-40	80-85	32-36	80-85	Strawberries.....	36-45	80-85	31-32	80-85
Oysters, in shell.....	34-36	80-85	34-36	80-85	Watermelon.....	40-45	80-90	32-36	80-85
“ in liquid.....	25-35	..	20-25	..	Dairy Products:				
Pigeons.....	34-36	80-85	33-34	80-85	Butter.....	36-40	80-85	0-10	..
Pork, Fresh.....	36-40	80-85	32-36	80-85	Buttermilk.....	36-40	80-85	..	..
“ Salt.....	36-40	65-70	32-38	65-70	Cheese, American.....	32-40	80-85	..	..
Poultry, Dressed.....	34-36	80-85	28-30	70	“ Cheddar.....	36-38	80-85	..	..
Sardines.....	36-40	..	..	..	“ Cheshire.....	38-40	80-85	..	..
Sausage, Fresh.....	36-40	80-85	32-36	80-85	“ Limburger.....	42-44	80-85	..	..
“ Smoked.....	40-50	70-75	32-36	65-70	“ Neuchatel.....	50-52	80-85	..	..
“ Casings.....	20-25	..	..	..	“ Roquefort.....	39-41	80-85	..	..
Tenderloin, butts.....	36-40	80-85	..	..	Cream, Fresh.....	36-40	80-85	..	..
Veal.....	36-40	80-85	34-38	80-85	Eggs.....	36-40	80-85	29-31	80-85
Veal, Brined.....	36-40	..	..	..	Ice Cream.....	0-10	..	..	..
Fruits:					Milk, Condensed.....	36-40	..	..	..
Apples.....	36-45	80-85	31-32	85-88	Milk, Fresh.....	36-40	..	..	..
Apricots.....	36-45	80-85	31-32	..	Milk, Skim.....	45-48	80-85	..	..
Avocados.....	40-45	80-85	34-36	80-85	Milk, Whole.....	34-36	80-85	..	..
Bananas.....	56-72	85-95	56-72	80-95	Oleomargarine.....	36-40	80-85	..	..
Blackberries.....	40-45	80-85	31-32	80-85	Miscellaneous:				
Cantaloups.....	40-45	80-85	32-36	80-85	Beer.....	45-50	..	32-36	..
Cherries.....	36-45	80-85	32-36	80-85	Chocolate.....	60-70	60	45-60	50-55
Cranberries.....	40-45	80-85	32-40	80-85	Flowers.....	45-55	85	36-40	80-85
Currants.....	36-45	80-85	32-34	90-95	Flour, Meal (wheat)...	70-80	60-70	70-80	60-70
Dates.....	50-60	75-80	..	..	Furs, Woolens.....	36-40	60	..	..
Figs, Fresh.....	45-55	80-85	50	80-85	Honey.....	36-40	..	..	..
“ Dried.....	36-45	75-80	35	75-80	Ice.....	28	..	..	..
Fruit, Dried.....	36-45	60-65	32-50	70-75	Maple Sugar.....	40-45	..	..	..
					Maple Syrup.....	40-45	..	..	..
					Molasses.....	40-45	..	..	..
					Nuts, Dried.....	35-40	45-50	..	..
					Tobacco, Cigars.....	35-60	80-85	..	..

THERMAL CONDUCTIVITY OF VARIOUS MATERIALS

MATERIAL	DESCRIPTION	DENSITY LBS. PER CU. FT.	MEAN TEMPERATURE °F.	"K"	AUTHORITY
EAGLE MINERAL INSULATION . .	Loose, Granulated and Felt	6	70	.24	Purdue Univ.
Balsa Wood		7.36	86	.35	B. of S.
Balsam Wool		2.2	..	.27	B. of S.
Cork	Granulated	4.8	59	.32	Biguard
Corkboard	Pure: No added Binder	14.0	90	.34	B. of S.
	With Bituminous Binder	15.6	86	.35	B. of S.
Cotton . . . . .		.85	90	.29	—
Hair Felt	Not Compressed	13.0	90	.26	B. of S.
Hairinsul	75% Hair, 25% Jute	6.3	90	.27	B. of S.
Kapok	Between burlap or paper	1.00	90	.24	B. of S.
Sawdust		12.00	90	.41	B. of S.
Shavings (Planer)		8.8	90	.41	B. of S.
Sugar Cane Fibre		13.5	70	.33	J. C. Peebles
Rock Wool	Fibrous Material	10.0	90	.27	B. of S.
Red Wood Bark	Fibre	3.0	90	.31	B. of S.



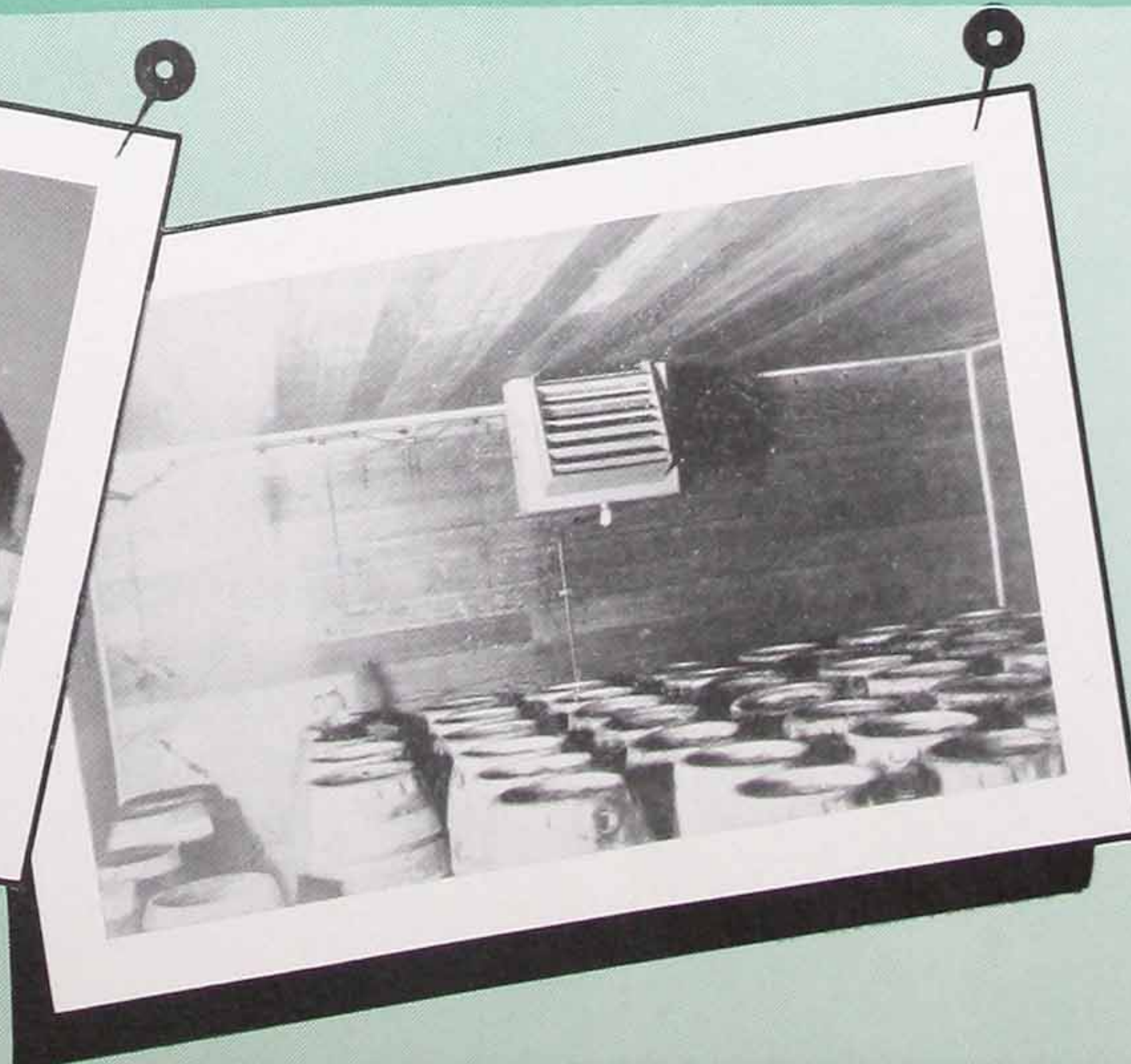
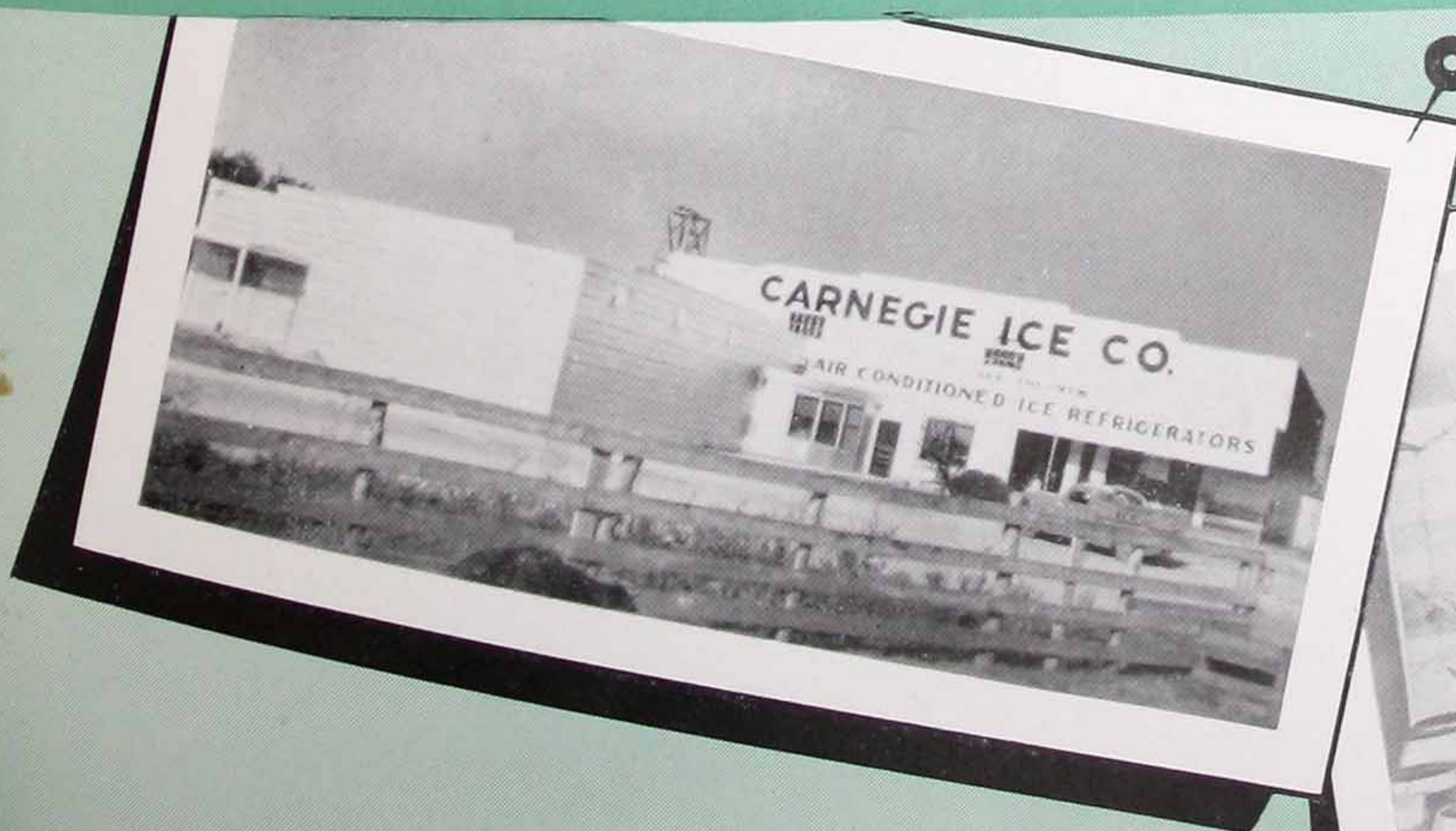
A Cold Room



Is Only as Good as its Insulation



Eagle Insulation Gives Maximum Low Temp Efficiency



SEE INSIDE FRONT COVER...

EAGLE-PICHER INSULATION

FOR HIGH AND LOW TEMPERATURES

INSULATING CEMENTS

Eagle Super "66" for temperatures to 1800°F.

Eagle "33" Insulating Cement for temperatures to 1800°F.

Eagle "111" Insulating Cement for temperatures to 2300°F.

FLAT MATERIALS

Eagle Supertemp Blocks for temperatures to 1700°F.

Eagle Blankets for temperatures to 1200°F.

Eagle L-T Felts for temperatures to 400°F.

PIPE COVERINGS

Eagle "77" and Eagle "88" for temperatures to 1200°F.

FILL MATERIALS

Eagle Insulating Wool for temperatures to 1200°F.

PROTECTIVE COATINGS

Eagle Stalastic for temperatures to 400°F.

Eagle Insulseal for temperatures to 450°F.

Eagle "43" Finishing Cement for temperatures to 800°F.

Eagle "20" Finishing Cement for temperatures to 1000°F.

Eagle "99" Finishing Cement for temperatures to 1000°F.

ANTI CONDENSATION (COMPOUNDS)

Eagle Swetchek for temperatures to 150°F.



THE EAGLE - PICHER COMPANY

AMERICAN BUILDING . . . CINCINNATI 1, OHIO